Electrical World

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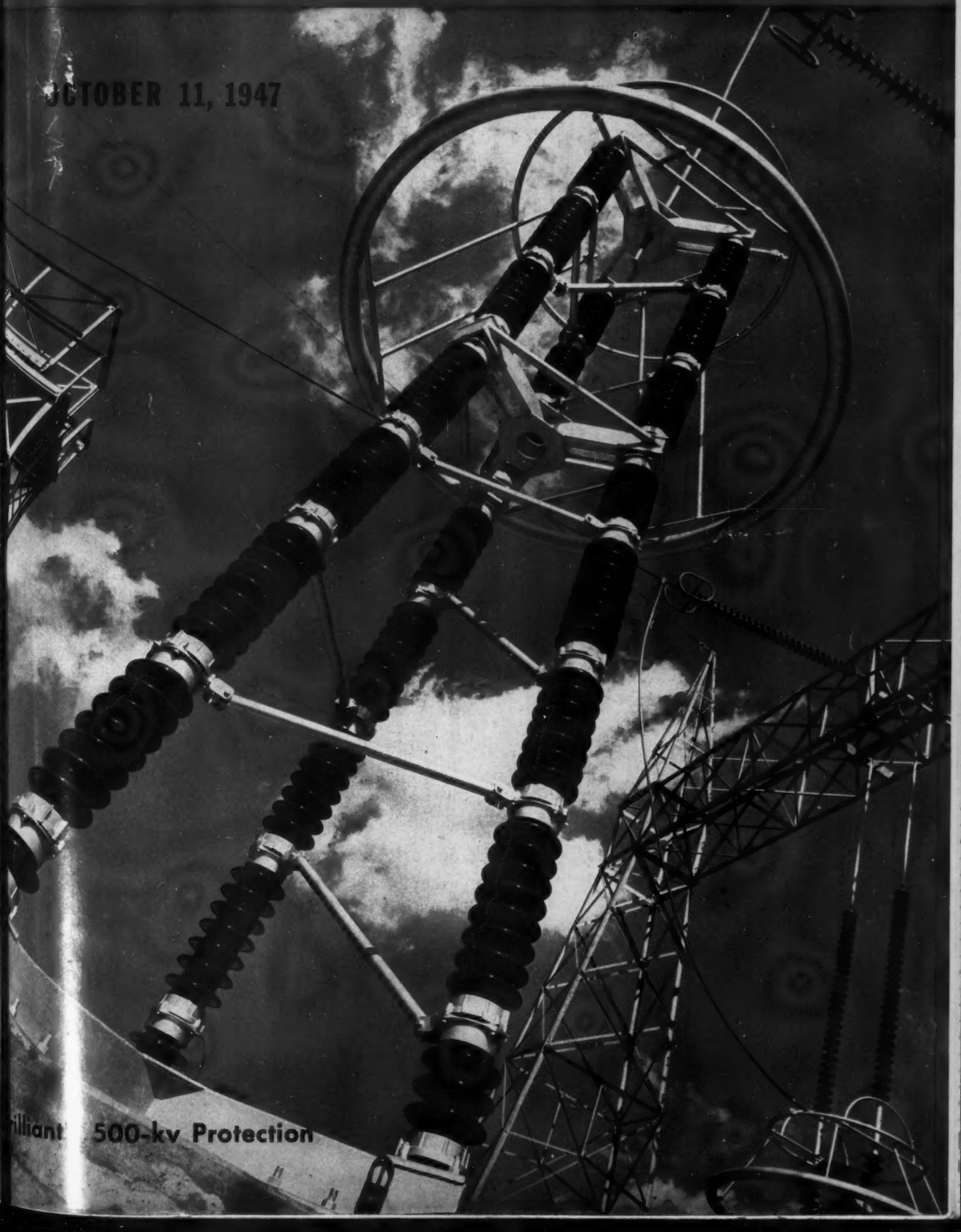

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Electrical World

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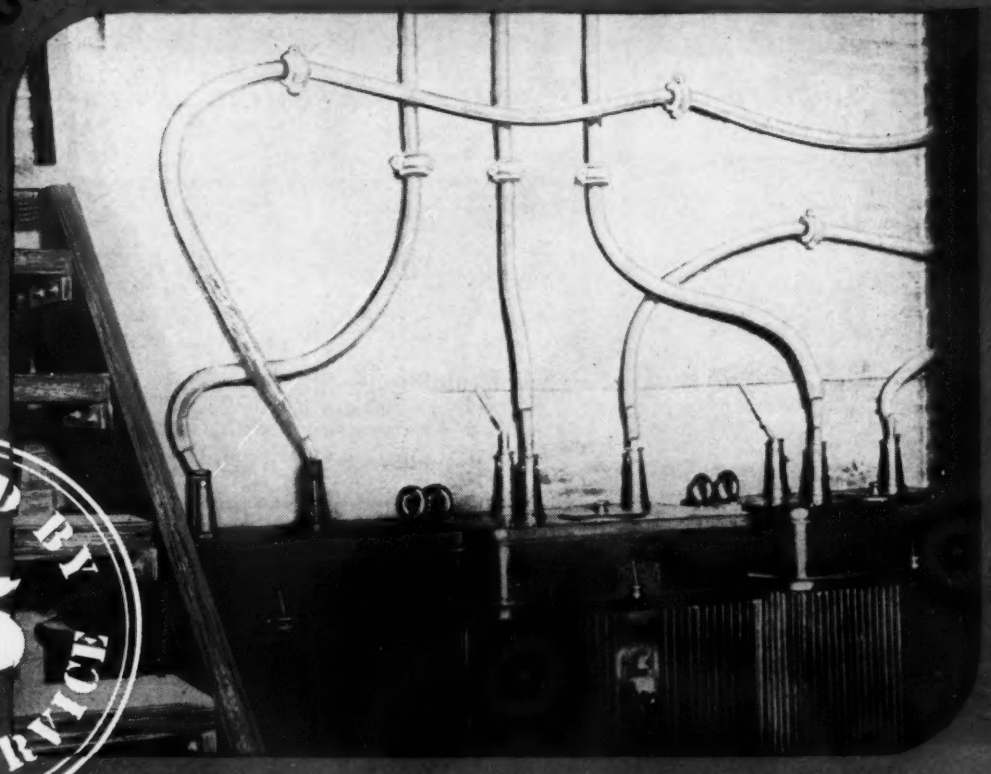
TIME puts its OK on KEYSTONE



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Electrical World — Editorials

OCTOBER 11, 1947

Setback for the Marshall Plan

SIXTEEN NATIONS accepted an invitation to draw up a realistic self-help plan for European reconstruction. The plan had meaning only to the extent that the United States indicated its willingness to make up the deficit. This was the Marshall idea.

The Marshall idea long since became known as the Marshall Plan. But it became a plan in reality only about two weeks ago in Paris, when the 16 participating nations released a report on the self-help plan they spent ten weeks in preparing.

Among other things, the Paris report deals with electric power. ELECTRICAL WORLD has looked carefully at the Paris report's data on power. Regretfully, we find that it just doesn't look good. Here's why:

The 16 participating nations, and western Germany, anticipate " . . . a growth of generating capacity by over 25,000,000 kw, or two-thirds above pre-war," by 1951. (Paragraph 35, Chapter 3, Paris Report.) These nations undertake to supply about 90 percent of this capacity themselves. (Paragraph 59, Chapter 3.)

Thus, in 51 months, 16 nations, many of them ravaged by war and the remainder of small account industrially, pledge themselves to supply about 22,500,000 kw of power equipment. This pledge is made seriously, no doubt, for it is, in effect, a character reference supporting a request for billions of dollars in United States relief and rehabilitation funds.

However, this pledge may be tested against the rigid standard of a comparable U. S. power program, now in full swing. In the United States, we have allotted 60 months for our matchless industrial machine—strengthened, not ravaged, by war—to manufacture 15,000,000 kw of generating capacity. In other words, we are attempting 50 percent less than these 16 nations, and giving ourselves almost a year longer in which to do it.

If all of this did not condemn the power portion of the Paris report as being beyond any reasonable hope of accomplishment, consider the following:

We can't imagine any significant heavy power equipment being manufactured in Iceland, Ireland, Norway, Denmark, Belgium, Luxembourg, Portugal, Austria, Greece or Turkey. From the remaining participants and western Germany, we can imagine production, yearly, in no more than these amounts: Sweden, 500,000 kw; United Kingdom, 1,000,000 kw; France, 400,000 kw; the Netherlands, 100,000 kw; Italy, 100,000 kw; Switzerland, 500,000 kw; and western Germany, 1,000,000 kw. These contributions total 3,600,000 kw yearly. We can imagine their achievement—but not without uninterrupted production, adequate labor, more food than is available in many localities, a steady flow of materials, and dependable fuel and transport.

With THAT hatchet?

The power program proposed in the Paris report has two parts. One is the various national programs, self-contained within individual nations. Cost of the combined national programs, which actually total 21,500,000 kw, according to tabular material in the report, is set at $5,000,000,000. The other part of the over-all Paris power plan is an "International Program," consisting of nine plants located, operated and serving without respect to national boundaries. Six of these are hydro. Actually,

(*Continued on page* 92)

★ ★ NEWS OF THE

FORGETTING all about the high-voltage test program, power engineers converge at the tent where the luncheon was served preceding the tests at Brilliant

500-Kv Test Lines Energized to Begin Research Program

"I WILL now energize the test lines at 500 kv."

With these matter-of-fact words, Philip Sporn, president of the American Gas & Electric Co, closed a switch impressing 500,000 volts on experimental transmission lines at Brilliant, Ohio, last week.

Thus was launched a program of research in high-voltage power transmission. It will seek to determine the economic and technical practicability of transmitting power in the voltage range approaching 500 kv.

These studies will be chiefly concerned with power transmission ability or power limit, reliability, and economics. Extensive investigations of corona will be of special importance because losses associated with it, at these high voltages, may be a major economic factor. Also, excessive corona may interfere with radio reception.

The research program is planned to run continuously over the next three years. It is being conducted at a field laboratory adjacent to the Tidd plant of the Ohio Power Co. There, a full-scale transmission system has been built to test the performance of towers, lines, and equipment at voltages up to 500 kv.

"This voltage is perhaps higher than any considered practical at the present time," Sporn explained in describing the research program to 200 power system engineers who attended the opening of the field laboratory October 1. "But in order to determine the factors of practicability," Sporn declared, "it is necessary to go beyond the practicable range. It is for this reason that we plan to go up to 500,000 volts."

Sporn pointed out that increased uses of electricity, new loads, and increased generating facilities have brought new dimensions to transmission. More transmission is needed to transmit the much larger blocks of power from the generation to the load centers.

"Ties between adjoining systems will have to be on a much larger scale and will require higher voltages than have been utilized heretofore," Sporn said, "if the economics of transmission are to be maintained in balance."

"In particular, we need to know the performance and behavior of air surrounding a high-voltage conductor . . . the performance of insulators which keep the electric pressure from breaking through to ground . . . the kinds of conductors and what arrangements can best accomplish transmission at these higher voltages. Finally, we need to have a great deal more information than we now have on the performance of other equipment that enters into the operation of the high-voltage system—the circuit breakers, the lightning arresters, and the transformers."

The project, which will examine these factors, was conceived and initiated by the American Gas & Electric Service Corp for the benefit of the associated companies in the AG&E central system.

Participating also is an outstanding group of electrical manufacturers. Westinghouse Electric Corp contributed the power transformers, lightning arresters, and measuring equipment. It has been active also in planning the investigation. The American Bridge Co and Locke Insulator Corp provided insulators and hardware. The Aluminum Co of America, General Cable Corp, and Anaconda Wire & Cable Co supplied the conductors, and the General Electric Co is supplying an oil circuit breaker and arrester. Three test lines, such as would be used in actual practice, were built. Two of them are 1½ miles long, the third, one span.

The test lines are energized by a bank of three single-phase transformers which convert energy from the 66-kv three-phase supply to a high-tension voltage, line-to-line, ranging from 264,500 to 500,000 v. The transformers, which have a bank rating of 5,000 kva, measure 33 ft from the bottom of the tank to top of bushing. They are delta-connected on the primary side and solidly grounded wye on the high-voltage side.

Buses connect the lines to the transformers. The special bus structure covers an area 340 ft by 220 ft. Upper conductors are 54 ft above ground. Ground wires extend over the transmission line and station and completely shield the bus structure. The bus itself is a 2-in. segmental-copper conductor to minimize corona on the bus and provide shielding for measuring leads that are carried inside the bus conductor.

Each of the two 1½-mile lines has

MANUFACTURERS played a big part in success of the tests and all had representatives present. In the left panel, left to right, are D. Simmons, General Cable Corp; R. G. Bellezza, Locke Insulator Corp; G. L. Draffan and W. H. Burleson, Ohio Brass Co. In the right panel, J. E. Talbott and L. F. Hickernell, Anaconda Wire & Cable Co; H. E. Kent, Edison Electric Institute; and W. S. Hill, Locke Insulator Corp

seven towers; two are deadend structures. Ground wires are 124 ft above ground at the towers. Their height can be varied within limits. Provision has also been made to vary the lateral spacing of line conductors between 32 and 45 ft. Height of conductors at towers is about 85 ft. Sag is 45 ft; average span about 1,100 ft.

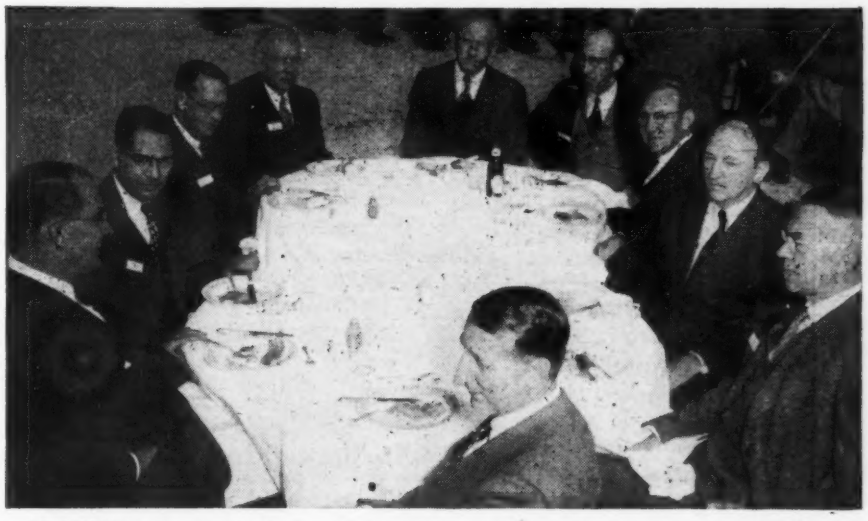
Line conductors are strung with 30 conventional 5¾-in.-spaced insulators per suspension string. Different types of grading rings are provided by the insulator manufacturers.

Several types of conductor will be tested. Those now installed are 1.65-in. OD segmental-copper conductors on one line; 2.0-in. OD ACSR with paper filler on the second line, and 1.65-in. OD stranded copper with I-beam core on the short line. Later it is planned to use a smaller single conductor segmental copper, and "bundle" or grouped conductor in the tests on the short line.

Two types of lightning arresters are provided to protect the transformers and to obtain service experience at these high voltages. Since the line will operate at 500 kv, at times, arresters with a maximum rating of 350 kv have been provided. Such a 70 percent arrester is justified because the system is well grounded. Provision is made to short-circuit sections of the arrester so that operating experience can be obtained on a proportional part of the arrester.

One of the two types of lightning arresters provided is self-supporting (see cover) using three-columns of elements. Each column consists of alternate sections of insulators and arrester units. The other arrester is suspended from the bus structure. Grading rings distribute the potential uniformly between individual units.

Instruments for measuring corona



AROUND the main table at the luncheon seated clockwise are A. C. Monteith, Westinghouse Electric Corp; E. R. deLuccia, Chief of the Bureau of Power, FPC; H. M. Sawyer, American Gas & Electric Co; G. H. Bucher, Westinghouse; Philip Sporn, AG & E; Graham Claytor, AG & E; Marvin W. Smith, Westinghouse; J. T. Copenhaver, West Virginia Public Service Commission; Harry A. Winne, General Electric Co. In the foreground is Harold Turner, Ohio Power Co

PLEASED with first day's results of high-voltage transmission research program, Philip Sporn, president of AG & E, and Harold Turner, vice-president of subsidiary Ohio Power Co, congratulate each other

loss are mounted in an aluminum box on top of transformer high-voltage bushings. Potential for the instruments is provided by extension of main high-voltage transformer winding. Corona loss is measured directly by wattmeters with current coils in series with the line. Power is measured by indicating instruments observed through a high-power telescope from an observation booth 60 ft away or can be recorded by graphic meters. Remote control of measuring equipment is provided by supervisory control relays operated from the observation booth.

Features toward which investigations will be directed initially in this field research on corona and other phenomena are listed:

1. Conductor sizes up to 2 in. in both segmental and wire form will be tested. Grouped conductors consisting of 2, 3, and 4 wires, spaced at distances in the order of 1 or 2 ft, will also be tested.
2. Number of insulators will be varied up to a maximum of 30.
3. Lateral spacing of conductors in flat configuration will be changed.
4. Height of ground wires will be varied in steps and the effect of the presence and absence of ground wires determined under identical weather conditions.
5. Conductor weathering will be studied.
6. Atmospheric conditions such as rain, fog, sleet, hail, and snow will be investigated.
7. Atmospheric electrical gradients at the ground and their variations with rain clouds and their influence on corona will be studied.
8. Insulator loss as affected by fog, sleet, and rain will be susceptible to determination.
9. Effects of all these factors on radio reception will be determined. In particular the conditions at the towers will be given careful attention.

Looking at the Newspapers
C. E. Wilson Finds Good News

SKIPPING deliberately, almost gayly, over depressing Page-one news of labor strife and international complications, Charles E. Wilson, president of General Electric Co, took a look last week at some of the less spectacular back-page economic news and found it good.

Back among the want ads, movie notices and other dull good news, he found evidence to support three optimistic views; First, that American economy is dynamic—going places; second, that nothing so far in sight can stop it; and third, that an unexpected social growth or coming-of-age is evident in America.

Speaking at a dinner following the dedication of new research laboratories of the Locke Insulator Corp, in Baltimore, Wilson credited the present dynamic character of American economy to several factors: (1) the ten-fold increase in industrial research since 1920—with its compelling influence on competition, progress, and prosperity; (2) the increase in national output, today 185 percent of prewar; and (3) the increase in worker output.

"Without too much straining on our part, we can extend the curve of economic progress into the future and project a reasonable national course of action . . . if we don't lose confidence in our own methods," Wilson said.

He pointed out that as American economy has grown and become more of an influence at home and abroad in shaping the destinies of people, we as a nation have been forced to make economic decisions and adopt policies unknown to uninhibited early industrialists.

"In this conscious economic policy-making," the GE president pointed out, "the chance for error is great. We must be sure today that we pursue policies which stimulate expansion of production, rather than hurt or strangle it. We must keep our eye on the ball."

Looking to the future Wilson saw industrial research as the key to progress through the development of new materials, methods and processes.

"It is no accident," he observed, "that our country is both the economic and the scientific center of the world, for the two go hand in hand. The increase in the number of scientists in America is our guarantee of increased competition through new enterprises. For over 70 years the number of physicists, engineers, chemists, and metallurgists has increased from 10 to 14 times as fast as the total number of gainfully employed persons, due largely to the rise of industrial research."

In all this Wilson saw evidence that America is reaching economic maturity. As examples, he cited America's consciousness of leadership and responsibility in the political-economic world, better state and local government, and more marked cooperation between industry and government.

No Bargaining with Unions

Tallahassee, Fla., city administration has refused to enter into any negotiations with the International Brotherhood of Electrical Workers, AFL. The city attorney said Florida law prevents the municipality from bargaining with unions.

Danville, Va., Votes Bonds for Steam Power Station

Danville, Va., citizens have voted a $1,500,000 bond issue to finance the construction of a steam electric generating plant. The issue was carried by only 41 votes, with 2,047 persons voting. Of these, 1,406 voted in favor of the issue. A two-thirds majority was needed.

Danville has a 60-year policy of municipal ownership. A few years ago, a $3,500,000 hydro plant was built at "The Pinnacles" in Patrick County.

For the past two years, the city has purchased extra power from the Appalachian Electric Power Co. The contract with the utility will expire by September, 1949. It is hoped to have the new steam plant in operation by that time.

Installation of New Equipment Is Utilities' Biggest Problem

13 Newspapermen Touring Industry's Construction Projects Find Operating Companies Building for Greater Energy Loads Than Any in Past but Taking Drastic Steps to Carry Today's

"NOT TOO LITTLE, but perhaps too late?"

That question is haunting the electric utility industry today.

The industry's five-year, $5,000,000,000 expansion program appears adequate to meet steadily mounting national power demands. But there is no assurance that the new equipment ordered, especially generating units, will be delivered and installed in time to avert critical power supply problems for many systems.

A group of 13 news correspondents, touring the industry's construction projects as guests of the Edison Electric Institute, found operating companies everywhere planning and building for greater energy loads than they have yet had to meet. On the other hand, the newsmen found most of the companies already taking drastic steps to carry present peak loads. Most of the systems visited were cutting—or had cut—voltage, at least at peak demand periods. Some had curtailed deliveries to consumers on interruptible contracts.

The immediate problem, of course, is in meeting winter peaks this year and in 1948. With deliveries of new equipment seven months to a year behind schedule, most company executives feel that their systems will have sufficient new generating capacity by early 1949 to be "over the hump."

Company Officials Optimistic

But company officials also are generally optimistic over the ability of their companies to meet peaks in the interim. Their attitude was summed up by H. B. Bryans, president of Philadelphia Electric Co, who told the newsmen. "We have never dumped any load and we are not going to dump any. It will be a tight squeeze, but we will make it."

Bryans, like most of his colleagues, conceded that breakdowns of presently operating equipment could change this prospect overnight. Practically all systems carried heavier loads this summer than any experienced in previous years. As a result, maintenance of equipment, usually completed in summer, was generally abandoned.

In the West, rainfall is another uncontrollable factor. Systems like those of the Idaho Power Co, Pacific Gas & Electric Co, and Southern California Edison Co, which depend heavily on hydroelectric generation, have been hard-pressed because of an unusually dry summer and early autumn. Heavy rains, which now are expected, would ease most of their power supply problems.

Pacific Gas & Electric has curtailed deliveries of reserve energy to industrial consumers. Three chemical plants served under interruptible contracts were cut back last month when PG&E ran out of surplus energy. The reduction amounts to approximately 50 percent of the energy normally supplied these plants.

Union Electric Co of Missouri also has cut back deliveries of surplus power. As early as last March, UE began interrupting service to a zinc reduction and a rubber reclaiming plant, picking up some 18,000 kw on the peak. In August, UE began curtailing service to three other heavy industrial consumers, further reducing their load by 28,000 kw on the peak. These consumers, however, receive all the power they need at other periods of the day.

UE encountered a record summer peak of 893,000 kw. The company expects the December peak will approximate 900,000 kw. It now has 615,000 kw of steam generating capacity and some 200,000 kw of hydro capacity.

With one of the country's tightest supply problems, UE will spend $92,000,000 during the five years ending 1951 for additional generating equipment and other facilities. It has appointed a load committee to investigate possibilities of obtaining additional power supplies from industrial plants and of effecting more efficient use of existing facilities.

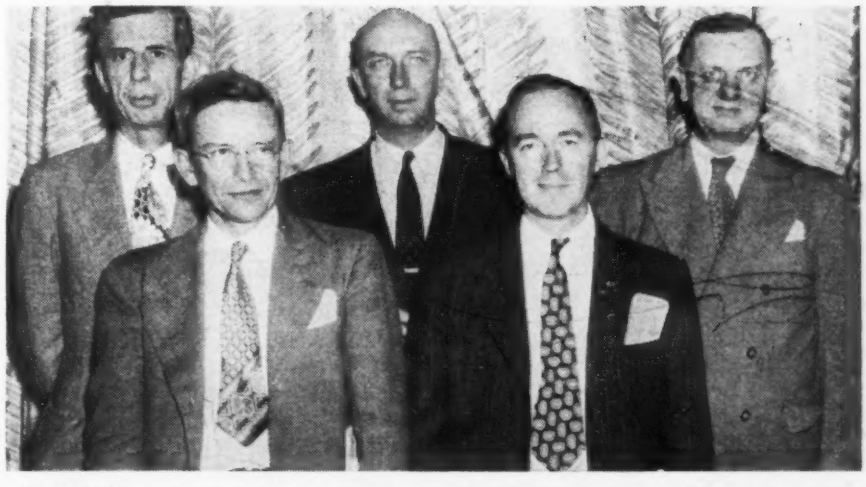
Southwestern companies, coping with greatly increased industrial loads, as well as the phenomenal residential demand experienced by utilities everywhere, figure they are past their seasonal peak for this year.

•

Contract Let for Addition to Harbor Steam Station

The Los Angeles Board of Water and Power has awarded a $1,916,667 contract for construction of the main building superstructure of an addition to the Harbor steam plant in Wilmington, Calif., to Guy F. Atkinson Co, Los Angeles.

The new building will house three 75,000-kw turbine generators, with boilers and auxiliary equipment. Two are scheduled to be placed in service in the fall of 1948, the other in 1949.



THESE five took an active part in the recent conference of the Engineering and Operation Section of the Southeastern Electric Exchange at Atlanta. Left to right, front row, H. B. Robinson, Carolina Power & Light Co, section chairman, and Miles Carey, Virginia Electric & Power Co., chairman of the Production & Transmission Committee. Rear row, W. L. Rush, Louisiana Power & Light Co, Distribution Committee chairman; W. R. Doar, Carolina Power & Light; and John W. Talley, executive secretary, Southeastern Electric Exchange

NLRB Decision Opens Way for UWU to Accept Taft Act

IBEW Has Met Requirements of Taft-Hartley Act—CIO Union Must Meet Them or Lose Ground to AFL Rival—Denham Will Abide by Board Ruling—Test Court Cases May Come Later

STEPS will be taken by the Utility Workers Union of America, CIO, next week to comply with the registration and non-Communist affidavit provisions of the Taft-Hartley Act in order to qualify for service from the National Labor Relations Board.

This was learned by ELECTRICAL WORLD after NLRB decided in a test case that the UWU's rival, the International Brotherhood of Electrical Workers, was qualified to bring cases to the Board because IBEW had met the requirements of the new law.

This decision upset the previous ruling of NLRB General Counsel Robert N. Denham, which would have required officers of the parent AFL and CIO to file non-Communist affidavits before any of their affiliates could qualify.

In a 4 to 1 ruling, NLRB members held that affidavits are required only from officials of the local and the International union of which it is a part. Financial data must also be filed with the Labor Department. The parent AFL and CIO need not register with the Labor Department or file affidavits by its officers except, perhaps, to qualify the 1,390 federal local unions which are affiliated directly with the AFL and the 400 local industrial unions affiliated directly with the CIO.

Denham Bows to Board

Stating that he is only a prosecutor before the court, Denham agreed to go along with NLRB's views. Thus, the same rule will be applied in unfair labor practice cases and union shop elections as the Board has set down for representation elections.

NLRB's decision came on an appeal of IBEW from a regional NLRB decision denying an election among five technicians at radio station WARL in Arlington, Va., owned by Northern Virginia Broadcasters, Inc, on the ground that the AFL officers had not complied with Denham's ruling. Compliance was blocked by John L. Lewis's refusal to sign a non-Communist affidavit.

Since the management in this case had originally agreed to a consent election and was not responsible for the IBEW's plight, it was not expected to make an issue of the NLRB decision which might force a court determination. This might have to come in some other case.

The UWU Board will meet in Boston during the CIO convention to take formal action with respect to complying with the law. The necessary forms have been obtained and are ready for mailing to the 230 local unions.

Only a decision by the CIO convention to prohibit member unions from complying with the law would cause UWU to withhold compliance, because this union still relies on the CIO for considerable support. But such action by the CIO convention is not likely.

It is necessary for UWU to bring itself within the jurisdiction of NLRB in order to compete with the IBEW in the electric utility industry. It has some 40 cases pending before NLRB which, if it does not qualify by October 31, will be thrown out the window. And the IBEW will be waiting to grab them.

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Idaho Utility Sold

The purchase by the Washington Water Power Co, Spokane, of the Pierce Light & Power Co, serving Pierce, in northern Idaho, has been approved by the Idaho Public Utilities Commission. Sale price was $26,500. Pierce Light was a partnership of Galen and Ethel M. Burkhardt. The Pierce City Council has passed an ordinance granting Washington Water Power a franchise and use of city streets and alleys for 25 years.

Record Set in August

Grand Coulee and Bonneville Dams broke all previous power production records in August, Bonneville Power Administration officials reported, with every generator at peak performance every day to produce 909,821,000 kwhr. The usual peak occurs in cold weather in December or January, it was reported.

NLRB Backs Employer Against Improper Union

Even though bargaining rights were established under the Wagner Act, the National Labor Relations Board apparently will not try to compel an employer to bargain with a union if the bargaining unit is not a proper one under the Taft-Hartley Act.

This has been indicated by the new five-man board in its first decision since the new law became effective August 22. Involved were the East Springfield (Mass.) Works of Westinghouse Electric Corp and the Foreman's Association of America, independent union.

This union was certified as bargaining agent for 152 supervisors after an NLRB election in May, 1946. Refused recognition because the company believed the supervisors were not "employees" within the meaning of the Wagner Act, but rather a part of management, the union filed a refusal-to-bargain charge. A complaint alleging an unfair labor practice was issued a year ago against the company by the regional NLRB director.

Because the Taft-Hartley Act denies bargaining rights to supervisors, the NLRB last week dismissed the complaint in an unanimous decision.

The Board made clear, however, it was dismissing the complaint because it "involves nothing except a refusal to bargain." The only remedy could have been to order Westinghouse to bargain with the supervisors, but this is no longer compulsory under the new law, hence could not have been enforced.

The significance of this is that the NLRB probably will not dismiss similar cases if they involve discriminatory discharges which occurred before August 22. Employers are likely to be ordered to correct any discrimination against individual workers which was illegal when it took place.

•

Michigan Co-op Gets Loan

The Thumb Electric Cooperative of Michigan, Ubly, Mich., has received approval of a $575,000 loan from the Rural Electrification Administration. The money is to be used for two 1,100-kw diesel generating units and for 15 miles of line.

•

30-Year Franchise Voted

DeLand, Fla., freeholders have voted the Florida Power Corp a 30-year renewal of its franchise. However, since the measure won by only 7 votes, a court contest may follow.

Locke Insulator Dedicates 2 Research Laboratories

One Will Be Devoted to Industrial Ceramic Research, the Other to High-Voltage Studies in Electrical Insulation—C. G. Suits, General Electric Co, Speaks at Ceremonies

LOCKE Insulator Corp last week dedicated two research laboratories at its Baltimore plant. One, the new Fred M. Locke Ceramics Laboratory, will be devoted to research in the broad field of industrial ceramics. The other, an existing high-voltage laboratory, named for its builder, Frank H. Regan, former president of Locke, will engage in high-voltage research in electrical insulation. Work at the new Ceramic Research Laboratory, according to R. G. Bellezza, president of Locke, will be along three main lines: development of closer control over materials and processes, evolution of new uses for ceramic materials, and the development of new ceramic materials and processes.

"Our aim is to be first in the field of clayramics," Bellezza declared. To achieve this aim the company has provided its researchers with three laboratories in one, for the Fred M. Locke Research Center consists of:

(1) A research laboratory for applied research on ceramic materials, (2) an experimental laboratory where research developments can be tried out full scale, before release to general production, and (3) a material control laboratory to assure maintenance of high standards of quality in materials and processes.

2,000,000 v Available

In the existing high-voltage laboratory, apparatus is provided for production of impulse voltages of nearly 2,000,000 v and commercial frequency voltages of over 1,000,000 v as well as machines for testing mechanical characteristics of both insulators and hardware.

At the dedication of the laboratories, brief ceremonies preceded inspection of the plant and research facilities by upwards of 150 guests from all branches of the electrical industry.

Dedication of the laboratories was by Dr C. G. Suits, vice-president of General Electric Co and director of the GE Research Laboratory. Dr Suits pointed to several specific fields that would benefit from planned research.

In ceramics new dielectric materials for condensers possessing special properties are needed, he indicated. Tetinates of barium strontium show promise, Suits said, of giving dielectric constants a hundred times higher than those common today. Development of the GE Research Laboratory may afford a new method of bonding ceramics to metal in electronic tube construction. And, where mechanical parts are subjected to very high temperatures, ceramics has another role, he pointed out. Coating of metal turbine buckets with ceramics has intriguing possibilities, he asserted.

Acceptance of the new ceramic laboratories was made for the electrical industry by Ernest R. Acker, vice-president of the Edison Electric Institute and president of Central Hudson Gas & Electric Corp. "As an industry," he pointed out, "we foresee the need for transmission lines with increased capacities and higher transmission voltages. Such new lines will inevitably create new insulator problems. Increased insulator strength will be required as an entirely new concept of the supporting insulation, for these lines may very likely be developed requiring ceramic developments far beyond present possibilities," Acker said. Much remains to be done in the joining of porcelain to metal parts to provide completely satisfactory bonds between these materials under all conditions. Present-day problems include the need for more accurate threads on pin-type insulators and the elimination of insulator troubles under abnormal weather conditions in some areas.

Also participating briefly in the ceremonies were several officials of the General Electric Co, Locke's parent organization, among them President C. E. Wilson, and Vice-Presidents Ralph Cordiner and Harry A. Winne.

•

Injunction Asked to Ban Expansion of Municipal

Illinois Power Co has sought an injunction in McLean County Circuit Court restraining Bloomington from further expansion of its municipal electric plant. The utility charged the city evaded or neglected to comply with Illinois laws in the expansion of its electric facilities.

The power company alleges that the city failed to call a proper referendum on its $2,000,000 bond issue, did not distribute annual reports showing the true results of municipal ownership and operation, failed to have the light plant accounts examined each year, and has not correctly shown the cost of maintenance, extension and improvements of plant.

TECHNICIAN at the new Fred M. Locke Ceramics Laboratory explains a [illegible] to President R. G. Bellezza, Locke Insulator Corp; President Charles [illegible]son, General Electric Co; W. S. Hill, Locke's manager of engineering; and C. B. Springer, assistant engineer of Locke Insulator

Industrial Atomic Energy Far Away, Says Lilienthal

AEC Chairman Appoints Civilian Consultants to Discover Ways for Industry to Use Atomic Energy

It will be a long time before atomic energy assumes any significant place in the economy of the country—so long, according to Chairman David E. Lilienthal of the Atomic Energy Commission, that today's economic planning need take little account of atomic possibilities.

"Our judgment is," Lilienthal told the Economic Club of Detroit this week, "that clearly no one should delay sound and economical additions to power supply, whether by fuel-generated electricity or water power, because somewhere in the future atomic energy will come on the scene as an additional source of supply. There will certainly be ample time to make whatever adjustments may be needed."

Later in the day Lilienthal announced a civilian committee of consultants charged with finding opportunities for industrial enterprise to use atomic energy. This group is headed by James W. Parker, president of Detroit Edison Co. Walker Cisler, chief engineer of power plants for Detroit Edison, will serve as executive secretary. Others include O. E. Buckley, Bell Telephone Laboratories; Donald F. Carpenter, Remington Arms; Dr. Gustave Egloff, Universal Oil Co.; Paul Foote, Gulf Research and Development; and Robert E. Wilson, Standard Oil of Indiana.

The civilian committee will be cleared by the Commission for access to secret data necessary to their deliberations. It is expected that they will spend many weeks in close association with the Commission's daily operations, be relieved of responsibilities to their own companies for the necessary period to assure thorough familiarity with the Commission's development program, and recommend ways and means for private industry to undertake a share of the future development.

Lilienthal repeatedly stressed the part private industry is to play in atomics. "In the soil of competitive private industry . . . the same soil that has nourished the automotive and other industrial giants . . . will flourish atomic development."

•

From Tacoma to Utility

Tacoma City Light has begun the diversion of 20,000 kw of power into Bonneville Power Administration lines for use by the Washington Water Power Co of Spokane and will continue to do so for an indefinite period. The power is being generated by the Tacoma steam plant, using coal as fuel, as a part of the Pacific Northwest Power Pool's effort to conserve water and oil.

CHARLES S. WALTERS, vice-president of the Carolina Power & Light Co, expresses his appreciation at recent ceremonies when the Waterville hydroelectric plant of the utility was renamed in his honor

MEETINGS

Previously Listed

International Association of Electrical Inspectors—Western Section, Mount Royal Hotel, Montreal, Canada, October 13-15; Eastern Section, Seaside Hotel, Atlantic City, October 20-22; Southern Section, George Washington Hotel, Jacksonville, Fla., October 27-29.

Electrochemical Society—Fall Congress, Copley-Plaza Hotel, Boston, October 15-18.

Missouri Valley Electric Association—Accounting Conference, President Hotel, Kansas City, Mo., October 16-17; Rural Roundtable, Skirvin Hotel, Oklahoma City, Okla., October 30; Sales and Rural Conference, Skirvin Hotel, Oklahoma City, Okla., October 31-November 1.

Pennsylvania Electric Association—Transmission & Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 16-17; Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, October 23-24; Systems Operation Committee, Irem Temple Country Club, Dallas, Pa., October 23-24; Communications Committee, Lord Baltimore Hotel, Baltimore, November 13-14.

American Standards Association—Annual Meeting, Waldorf-Astoria Hotel, New York, October 21-23.

National Electrical Manufacturers Association—Annual Meeting, Hotel Traymore, Atlantic City, October 27-31.

Southeastern Electric Exchange—Sales Conference, Biltmore Hotel, Atlanta, October 29-31.

National Electronics Conference — Edgewater Beach Hotel, Chicago, November 3-5.

American Institute of Electrical Engineers—Midwest General Meeting, Congress Hotel, Chicago, November 3-7.

International Lighting Exposition and Conference—Stevens Hotel, Chicago, November 3-7.

SEC RULINGS

MONONGAHELA POWER Co has been authorized to sell $7,000,000 of 30-year first mortgage bonds and 40,000 shares of $100 par cumulative preferred stock through competitive bidding. Proceeds will be used for construction purposes. (Release No. 7702).

CONSOLIDATED ELECTRIC & GAS Co's amended application covering the issue and sale of $5,900,000 of 2¾ percent one-year promissory notes at par to the Central Hanover Bank & Trust Co, New York, and the Continental Illinois Bank & Trust Co, Chicago, in the amounts of $2,950,000 to each bank has been granted. Proceeds of the notes, with other corporate funds, are to be used to retire bank notes now outstanding in the amount of $6,070,000, maturing in November, 1948. (Release No. 7722).

ALABAMA POWER Co's proposal to sell its bus properties in and around Tuscaloosa, Ala., to Marc Ray Clement for $206,100 cash has been approved. (Release No. 7730).

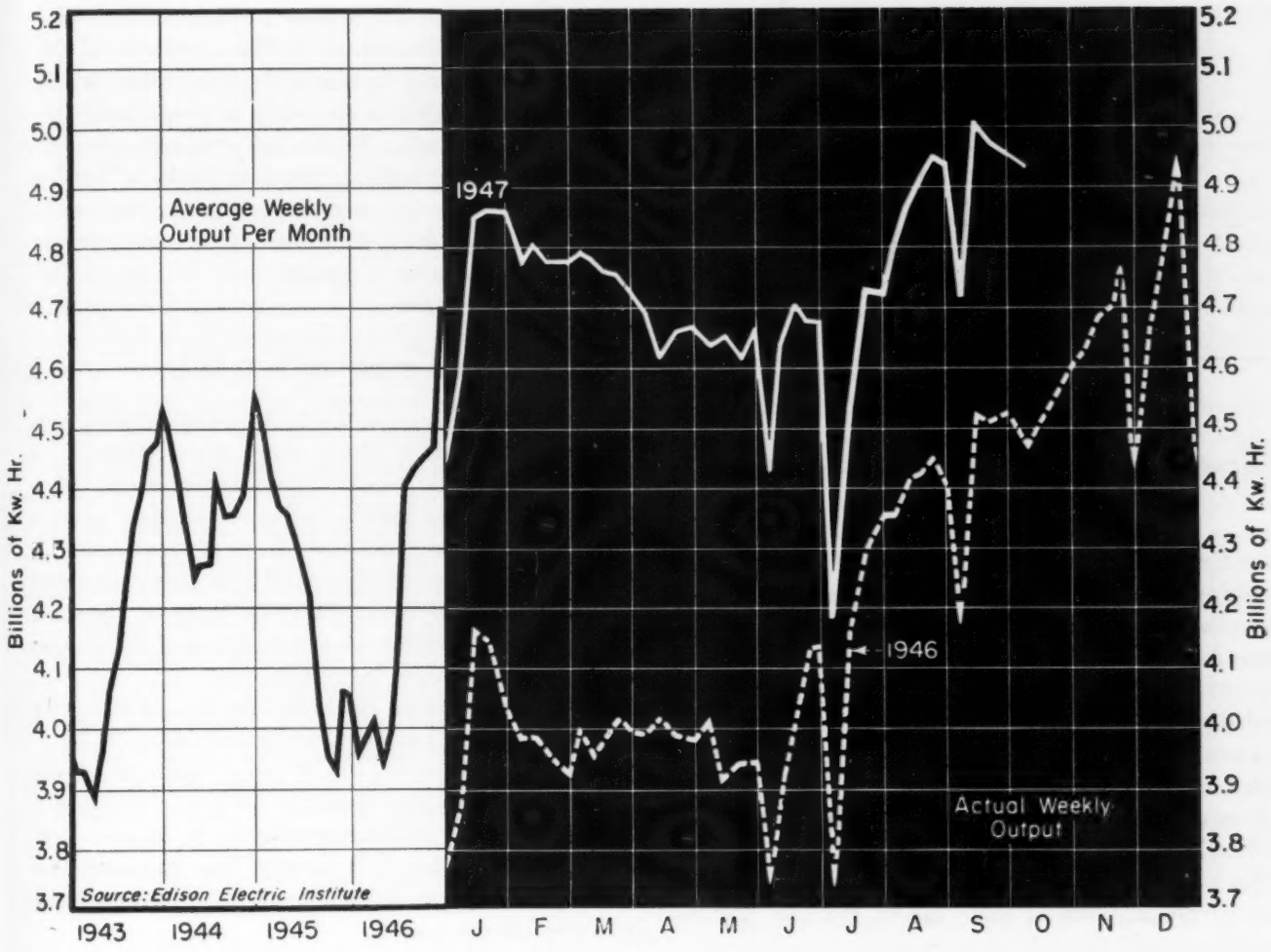
TEXAS ELECTRIC SERVICE Co, a subsidiary of the Texas Utilities Co, has received permission to sell at competitive bidding $7,000,000 of first mortgage bonds, series due 1977. Proceeds will be used to finance construction and other purposes. (Release No. 7731).

CITIES SERVICE POWER & LIGHT Co has been authorized to distribute a special fund of approximately $100,000 to five officers and directors of the company and its parent, Cities Service Co. In issuing the ruling the commission decreed that the securities purchased by the officers and directors prior to the commencement of reorganization proceedings under Section 11, but not in contemplation of such proceedings or of the reorganization plan of Power & Light, were entitled to the same treatment in reorganization as that accorded publicly held securities of the same classes. Under the plan, Power & Light paid off its publicly held debentures at par and accrued interest and its publicly held preferred at $100 plus accrued dividends. (Release No. 7720.)

CONSUMERS POWER Co has been released from commission jurisdiction heretofore reserved with respect to the fees and expenses of counsel in connection with the competitive bidding under Rule U-50 in connection with the $25,000,000 first mortgage bonds previously authorized. (Release No. 7734.)

LONG ISLAND LIGHTING Co's proposal to issue and sell to four commercial banks an aggregate of $5,000,000 principal amount of eleven-month notes, bearing interest of 1¼ percent, has been approved. Proceeds from the sale of the notes will be used for the company's construction requirements. (Release No. 7741.)

METROPOLITAN EDISON Co's proposal to sell $4,500,000 of first mortgage bonds, due in 1977, at competitive bidding has been sanctioned. Proceeds will be used for new facilities. (Release No. 7745.)



St. Lawrence Power Plan Denounced by Revercomb

A serious Senate row over the proposed St. Lawrence seaway and power project is in prospect for the next session of Congress. Notice to this effect was served on adherents of the project last week by Sen Chapman Revercomb, West Virginia Republican.

In a series of radio talks, the chairman of the Senate Public Works Committee denounced the St. Lawrence development proposal as a "wholesale invasion of private endeavor on the part of the federal government."

During the last session a bill providing for construction of the project was approved by the Foreign Affairs Committee, but it was not reported back to the Senate for debate. The measure was sponsored by Senator Arthur Vandenberg and 15 other senators. Hearings on an identical bill were started by the House Public Works Committee.

Senator Revercomb conceded that these measures were "very likely" to get Congressional attention next year. He charged that construction of the project would be "irreparably harmful" to West Virginia's coal and steel industries, as well as imposing a "vast and burdensome debt" on the national economy.

He particularly scored the hydroelectric development planned in conjunction with the Seaway improvements. This plan he described as "but another idea of those who advocate government control as against private enterprise."

•

Australia Adopts 220 Kv

Australia has adopted 220 kv as standard for long-distance power transmission. Previously the standard was 132 kv. The first of the higher-voltage lines will be erected between the Kiewa hydroelectric plant and Melbourne. A similar line will be erected between the Yallourn steam station and Melbourne. The former line will be 158 miles long, the latter 90 miles.

Other News

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Output Moves Downward

For the third consecutive week, the electric output curve moved downward during the week ended October 4, 1947, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power companies totaled 4,934,851,000 kwhr, comparing with 4,956,415,000 kwhr during the preceding week. During the week ended October 5, 1946, the total amounted to 4,478,092,000 kwhr, this year's figure being a 10.2 percent increase.

Weekly Output, Millions Kwhr

1947		1946		1945	
Oct. 4	4,935	Oct. 5	4,478	Oct. 6	4,028
Sept. 27	4,956	Sept. 28	4,518	Sept. 29	4,039
Sept. 20	4,977	Sept. 21	4,507	Sept. 22	4,019
Sept. 13	5,053	Sept. 14	4,521	Sept. 15	4,106
Sept. 6	4,721	Sept. 7	4,184	Sept. 8	3,909
Aug. 30	4,940	Aug. 31	4,404	Sept. 1	4,137
Aug. 23	4,953	Aug. 24	4,444	Aug. 25	4,116
Aug. 16	4,923	Aug. 17	4,422	Aug. 18	3,939
Aug. 9	4,874	Aug. 10	4,412	Aug. 11	4,395
Aug. 2	4,806	Aug. 3	4,351	Aug. 4	4,432

Percent Change from Previous Year

	Oct. 4	Sept. 27	Sept. 20
New England	+ 7.7	+ 6.9	+ 6.1
Mid-Atlantic	+ 6.6	+ 6.1	+ 8.8
Central Industrial	+15.2	+12.9	+11.7
West Central	+ 9.7	+10.5	+11.4
Southern States	+ 7.8	+ 8.9	+11.7
Rocky Mountain	+16.7	+20.0	+16.0
Pacific Coast	+ 8.6	+ 7.5	+ 7.8
Total United States	+10.2	+ 9.7	+10.4

Electrical World
OPINION

Marshall Plan—*(Continued from page 83)*

these figures are pretty meaningless, for they contain no breakdown beyond the stark word—"kilowatts." There is no indication as to number or size of generating plants, ratio in kilowatts between hydro and thermal-electric capacity, or of the amount of equipment which will be needed beyond the generating station. The report does note that new transmission will be erected only in conjunction with some of the hydro capacity.

How does all this affect the United States electric utility man? Well, it is the only tangible data the United States has at hand as public opinion is being harangued increasingly in favor of more aid to Europe. We are threatened daily, through all mediums of communication, with the very real menace of a Red empire bounded by the Atlantic. We are, in short words, being sold the Marshall Plan—and ELECTRICAL WORLD has no fault to find with that proposition as such.

But if this be what we must buy, the U. S. electric utility man had better look closely. By no stretch of the imagination is one prepared to believe that Europe can do the power job it is here pledged to do. So what happens, then, when it fails to do this fantastic job? Is the U. S. electric power industry then to step aside under the renewed threat of a Communist Europe? Is the U. S. power industry then to give up equipment it needs ever so sorely, or is it to give up space in the U. S. manufacturing shops to make up the difference between European performance and European pledge?

One can conceive that the whole "stop-Russia-where it-is" policy—to which this nation is committed—might reach an extreme where even this would be necessary. But we don't think this policy has to reach such an extreme and we do think that the best way to insure that it never does is to get the thing right before we buy. The power portion, at least, of the Paris report just isn't right. If bought by the United States as presented, it will fail or it will be bailed out by U. S. electrical manufacturers and U. S. power systems. Therefore, it had better be right before it is bought.

How to make it right before it is bought? This can be done two ways. One is to reduce it to achievable levels—and that is a negative approach. The other is to take the steps which permitted us, during the war, to turn out the equivalent of 10,000,000 kw yearly in power generation equipment. ELECTRICAL WORLD isn't recommending, for or against, either method. Such a decision involves factors whereof we may not properly judge. But we do recommend, urgently, that no one buy the power portion of the Paris report as it stands.

All this brings us to

The Marshall Plan as a Whole

which bears directly upon the U. S. power industry from two aspects—indirectly from many more. Directly, it threatens that 15,000,000-kw domestic program the industry is straining so hard to achieve. Directly also, it threatens to continue indefinitely the days of tax payments amounting to 20 percent of gross. Both threats are serious. The one aims at the industry's ability to serve; the other at its ability to pay for what it must have. But neither threat necessarily need become fatal.

There is, for instance, good reason to believe that if the job were organized specifically for such purpose, U. S. electrical manufacturers could supply domestic needs and export meaningful quantities of power equipment. It might or might not take another WPB, another Controlled Materials Plan, and another War Manpower law to achieve it. But it could be done if the public considered it worth the trouble.

Taxwise, again the threat could be harmless. After all, the electric utility man—and everyone else—has been paying heavy taxes for European relief without making visible progress. The alternatives being what they are, he's pretty certain to continue to finance Europe indefinitely. Thus, if relief shall become constructive, the electric utility man will be buying something with his tax dollar, instead, merely, of buying more of the same—which has been nothing. If these taxes buy nothing more than a definite, safe cut-off date for European relief—a promise of future tax reductions—they will buy more than they have thus far.

Brilliant Free Enterprise

WE HEAR a lot these days about the decline of free enterprise and the trend to collectivism. Last week at Brilliant, Ohio, we saw free enterprise working and came away convinced that there's nothing wrong with it.

For out there in the hills of eastern Ohio, a group of private power companies and competitive electrical manufacturers have plowed a few hundred thousand dollars, of profit, into a research program to find out if it is practical to transmit large blocks of power at voltages higher than anyone has tried before. If they succeed, the task of supplying power to the burgeoning loads of American industrial centers will be vastly simplified.

It is through such trail blazing that the art of electric power generation, transmission and distribution has advanced further in this country than anywhere else on the face of the globe. It has done so under the spur of the free-enterprise system.

It was the power companies of the American Gas and Electric system who saw the need for this study and enlisted the support of an outstanding group of electrical manufacturers who readily donated the necessary apparatus for the field laboratory.

The job they tackled jointly is a big one. Significantly, no one in Washington told them to tackle it. Nor did they have to go hat-in-hand to front office bureaucrats to get permission. It was their money. It was their time. They chose to follow the traditional course of plowing it back into the business for research.

But that is not all. When the project is done and the conclusions are reached no iron curtain will cloak the results. The information will be right there, in print, where anyone can apply it—where all groups can use it to bring more power to the people of this country at lower and lower costs. This has always been the aim of the free enterprise system.

This is the story we saw at Brilliant last week. It is the story of free enterprise at work—of a system that bureaucracy can't beat.

Explanation and Challenge

IT'S the same cause that shoots steak up to a dollar a pound. A lot of people have been and are getting a lot more money than they ever got before. That's why the national average residential use of electricity climbs to unexpected levels.

The reason is set forth in graphic detail in a pamphlet, "This Changed America," just published by McFadden Publications, Inc. Eight years ago, 88.3 percent, of the nation's families had incomes below $3,000 per year; now it's 72.1 percent. Sixty-nine and seven tenths percent in 1939, had less than $2,000; now it's 41.5 percent. Thirty-three and two tenths percent, in 1939, had less than $1,000; now it's 13.3 percent. That's how the picture has changed.

More people are working today than seven years ago. Then there were 45.1 million employed. For last summer, the employment estimate is 60 million. Percent of labor force employed rose from 85.1 to 96.1. This means more people have more money to spend.

When people continue to buy expensive cuts of meat at rising prices, they are not likely to stint themselves in the conveniences and comforts of a service whose price has not risen. How high would the average residential use of electricity be now if manufacture of electric appliances and utility load building had not been interrupted by the war? There is something for the electrical industry to think about as it resumes selling activity. A big piece of lost ground to be regained, isn't it?

WASHINGTON COMMENT

W. B. WHICHARD

RELIABLE political analysts generally agree that no major change in the Taft-Hartley Act is likely to be enacted by Congress in 1948. Accepting this premise, and it is a well-reasoned one, it behooves utility management, as well as labor, to anticipate some consequences of living with the present law for another year.

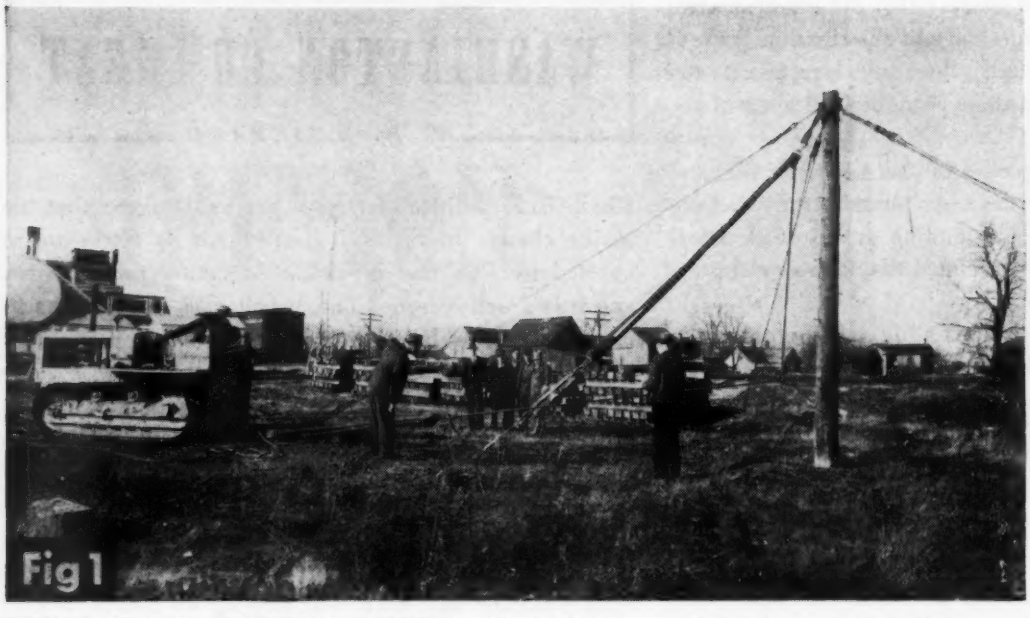
A virtual certainty, once AFL's International Brotherhood of Electrical Workers and CIO's Utility Workers Union of America comply with provisions of the Act prerequisite to operating under protection of the National Labor Relations Board, is a marked increase in union "raiding." Officials of both IBEW and UWUA openly predict that each will step up its efforts to gain "converts" among electric utility employees now affiliated with the other. Such activities, they say, are permitted, even encouraged, by Sec. 9 (b) of the Act.

Among other things, this proviso forbids NLRB to "decide that any craft unit is inappropriate" as the collective bargaining representative of any group of workers "unless a majority of the employees in the proposed craft unit vote against separate representation." Heretofore, NLRB generally opposed establishment of separate craft units among employees of a single utility.

Sec. 9 (b) apparently will permit a company's office workers, now grouped with other employees in a UWUA union, for example, to form an IBEW, or independent, craft unit. The office workers need only petition NLRB for an election among themselves. The question on the ballot would be: "Are you opposed to a separate craft unit to represent you?" If the majority of office workers voted "No," they could ask NLRB for another election, to select their union—UWUA, IBEW or independent.

Utility labor leaders already must have listed, mentally, at least, companies where such tactics might prove fruitful. For example, employees of the Pennsylvania Power & Light Co might well be the targets of a UWUA "raid." Only last year, an independent union maintained its right to represent PP&L's employees in an election bitterly contested by UWUA. Claiming that it was favored by a majority of the company's outside workers, UWUA then sought to establish a separate craft unit for these employees. But NLRB refused its sanction, exercising its former authority to name the "appropriate bargaining unit." Now UWUA can seek a separate unit which NLRB cannot now forbid.

"Raiding" has obvious unpleasant consequences for utility management. Of course, it cannot start until either IBEW or UWUA, or both, qualify under the Act for NLRB support. Since both unions are eager so to qualify, they will find the means. Management's headaches over "raiding" are about as close as the aspirin bottle.



PULLING AN 8-IN. EXPANDING ANCHOR in March, during rain and light snow, temperature above freezing (Fig 1). Soil class 7, very soft clay. Note water in pocket close to anchor installation. Angle of anchor rod, depth of setting and speed of

Good Anchoring is Inexpensive

DAVID C. HUBBARD
and
BRUCE O. WATKINS
A. B. Chance Co
Centralia, Mo.

RULES AND FORMULAS for determining the load on a guy for a given type of line construction and wind and ice conditions are well established. But, by comparison, very little has been said about the conditions affecting the anchors that must hold the guys. The values of "holding power" for anchors, often classified according to the square inches of anchor area, neglect conditions of the soil, depth of the anchor and other factors in testing. The term itself is misleading because it refers to the force required to pull an anchor out of the ground rather than the force the anchor will sustain.

To contribute to the intelligent selection of an anchor for a given set of conditions, development of more usable tables, supplemented by adequate descriptions, is needed to give engineers and construction supervisors the information required for anchoring. The accompanying tables are based on a study of hundreds of tests made in all parts of the country during the past 25 years. The conclusions reached have been further verified by additional tests in many different soils throughout the country.

Three primary variables affecting the holding powers of a given anchor are revealed in the test data: a) The depth of setting of the anchor; b) the speed with which the anchor is pulled; and c) the amount of moisture present in the soil. Of these variables, depth and speed can be controlled.

In determining a "standard" depth, a minimum value was chosen such that test results indicated fairly uniform holding values for a single soil description. These data indicated that this depth varied somewhat according to the size of the anchor. For reasonably consistent results (within about 15 percent variation), the larger anchors required a deeper setting than smaller ones. The standard or basic depth thus set up was used in determining the values given in the anchor tables (See Table 1).

It was found that the faster an anchor was pulled, the higher would be the reading on the dynamometer. Therefore, the slowest speed at which a tractor would operate, pulling on the fall line of a set of 3-3 blocks, was established as the procedure for the final tests.

These variables controlled, it became possible to evaluate the data on the basis of one unknown—the description of the soil. The result of this analysis was surprising. If the soil names were dropped, retaining only a moisture classification, test results began to dovetail within fairly close limits into eight soil groups. Weaker soils lacking a clay binder were placed in a separate category.

The next problem was to make the specification for each of the groups usable to the man in the field. Soil names were unreliable because of so much overlapping in holding strength. Different individuals do not give similar descriptions to the same specimen. However, each individual could pick up a portion of the soil and work it in his hands.

Since moisture content was the primary factor, and since the amount of moisture present definitely affects the degree of softness, it naturally

pulling are important factors (Fig 2) This test in early May, soil classification 5. "Pull-out" actually describes the test results obtained, while "holding power" values may be misleading. A slow steady pull, as shown in Fig 3, is essential for reliable results

Guy Insurance Against Storms

Proposed soil classification by moisture factor . . . "Holding power" figures replaced by ultimate soil-anchor holding strength . . . New tables offered

followed that the degree of softness, or hardness, should serve as an ideal means of soil classification. Some specimens will vary in moisture content with the change in seasons more than others, due to drainage conditions, and this too should be considered. Thus a man can feel the type of soil under examination, see at the same time whether the site is well drained, or is a catch basin during the rainy season. He can consider the weather conditions during the adverse seasons, and from new tables as presented herein, determine the anchor he should specify for the job. Using the moisture classification, it is no longer necessary to worry about the color of the clay—or whether it really is clay or something else with clay in it. The criterion is to pick up a piece of the soil and squeeze it in the hand.

Using this idea as a basis, the following soil classifications and definitions have been set up. These definitions should materially assist laymen and engineers alike in selecting the proper anchor for a given load.

Class 1. *Hard Rock*—Solid.

Class 2. *Shale, Sandstone, Soft Rock*—Solid or in adjacent layers.

Class 3. *Hard, Dry* — Hardpan. Usually found under a class 4 stratum. Resembles soft rock. Requires use of digging bar.

Class 4. *Crumbly, Damp* — Clay may predominate. Insufficiently moist to pack into a ball when squeezed. Particles crumble off.

Class 5. *Firm Moist*—Usually clay predominates. Other soils commonly present. May contain small stones, gravel, or sand. When squeezed by hand will form into a firm ball. Most soils in well drained areas, other than hillsides, fall into this classification.

Class 6. *Plastic, Wet* — Usually clay predominates as in class 5. Due to unfavorable moisture conditions, such as areas subjected seasonally to heavy rainfall, sufficient water is present to penetrate the soil to appreciable depth. Though the area is fairly well drained, the soil during these seasons becomes plastic and when squeezed will readily assume any shape. This soil is not uncommon in fairly flat terrain or in close proximity to rivers and marshes.

Class 7. *Loose, Dry* — Found in arid regions where sand or gravel predominates. Filled-in or built-up areas in dry regions or in very dry seasons fall into this class. As the term implies, there is very little bond to hold the particles together.

Loose, Wet—same as Loose, Dry for holding power. High in sand, gravel, loam, or silt content. In general, soil resembles mud and usually the anchor hole will disclose free water draining into it. Holding power in favorable seasons may approach Class 5, but due to the perosity of the soil it absorbs excessive moisture readily during rainy seasons or high tides, with a resultant loss of holding power. Predominant in poorly drained areas and in areas where there is no drainage at all. This class also includes

very soft and wet clay conditions.

Class 8. *Swamps and Marshes*—Includes areas that are marshes only seasonally.

Since the moisture content of the soil is one of the primary variables affecting the holding power of an earth anchor, the strength of the soil may vary during the calendar year. Tests made on anchors in selected areas bear this out. Some anchors installed during the summer in firm ground were pulled while the ground was still firm. Others remained in the ground until the following spring, and were pulled while the ground was soft.

The holding power of the anchors pulled in the spring was less in every case than for those pulled in the same location during the summer months. The reduction in holding strength corresponded to the soil classification at the time of the test. In the most unfavorable locations the value during tests was nearly 50 percent less for the spring test. In a location considered as average for fairly flat land, the loss was roughly 25 percent. Plate-type anchors installed in holes roughly at right angles to the guy displayed somewhat less loss of holding strength than anchors requiring a hole or disturbed earth in line with the guy. This may be due to the fact that, however well tamped, the replaced earth over an expanding, cone, or screw-type anchor does not resist water penetration as well as undisturbed ground. Therefore a larger quantity of water permeates the earth about the anchor in the critical area bearing the thrust of the anchor.

Based on an analysis of tests carefully selected for uniformity in test set-up and proper soil classification, the ultimate holding values of various types and sizes of anchors were first plotted on log-log paper, and then made up into tabular form according to the soil classifications as established above. The results are shown in Table 1. In selecting an anchor for a particular application, the type of soil should be considered. Table 2 gives the anchors suited for various types of soils and conditions.

Adequate safety factors must be considered for holding power of the anchor, the rod, and the guy wire. Given these factors, a properly anchored line, low cost insurance for storms, is assured.

Table I—Ultimate Soil-Anchor Holding Strengths of Various Anchors in Different Soils

Expanding Anchor

ANCHOR Size in.	ANCHOR Area sq in.	ROD Diam in.	ROD Length ft	AVERAGE ULTIMATE HOLDING VALUES—LB in Soil Class 3*	4	5	6	7
6-2 Way	50	½	7	13,000	11,000	9,000	7,000	4,000
6-4 Way	70	⅝	7	16,000	14,000	11,000	8,500	5,000
8-2 Way	98	⅝	7	20,000	17,500	13,500	10,500	7,000
8-4 Way	115	⅝	7	22,000	19,000	15,000	11,500	7,500
8-4 Way	130	¾	7	24,000	20,500	16,000	12,500	8,500
8-4 Way	130	1	7	24,000	20,500	16,000	12,500	8,500
10-4 Way	200	1	10	31,000	26,500	21,000	16,500	12,000
12-4 Way	300	1	10	40,000	34,000	26,500	21,500	16,000

* Expanding anchors are hard to install in this class soil.

Plate Anchor

6 x 17	102	⅝	7	21,500	18,500	14,500	11,500	7,500
6 x 22	132	⅝	8	25,000	21,500	17,500	13,500	9,500
8 x 22	176	¾	8	30,000*	26,000*	20,500	16,000	11,500
8 x 27	216	¾	9	34,000*	29,000*	23,500	18,500	13,500
8 x 35	280	1	10	41,000	34,500	27,500	22,000	16,500
10 x 40	400	1	10	50,000	43,000	34,000	27,500	21,000

* Exceeds strength of rod indicated (no factor of safety).

No-wrench Screw Anchor

ANCHOR Size in.	ANCHOR Area sq in.	Rod Diam in.	Rod Length ft	AVERAGE ULTIMATE HOLDING VALUES—LB in Soil Class 3	4	5	6	7
4	12½	⅝	4½		6,000	4,500	3,000	1,500
6	28	¾	5½		8,500	6,500	5,000	2,500
8	50	1	5½		11,000	8,000	6,500	3,500
10	78	1¼	5½		13,000	10,000	8,000	4,500
10	78	1¼	8		16,000	12,500	10,000	6,000

Wrench Screw Anchor

6	28	½	5½	8,500	6,500	5,000	2,500
6	28	⅝	5½	8,500	6,500	5,000	2,500
8	50	⅝	5½	11,000	8,000	6,500	3,500
8	50	¾	5½	11,000	8,000	6,500	3,500
10	78	¾	5½	13,000	10,000	8,000	4,500
10	78	¾	5½	13,000	10,000	8,000	4,500

Cone Anchors*

6	37	½	6	10,000	8,000	6,000
8	63	⅝	7	14,000	11,000	9,000
10	104	⅝	7	19,000**	15,000	11,500
12	132	⅝	8	21,500	17,500	14,000
16	239	¾	9	31,000**	25,000	20,000
19	336	1	10	38,500	31,000	25,000
23	467	1	10	47,500**	38,000	30,500

* Anchor installations must be well tamped with 12 in. of rock.
** Exceeds strength of rod indicated (no factor of safety).
Note: In Class 2, shale or stone, cone anchors develop the strength of the rod.
Average ultimate strength of rods: ½-in., 10,000 lb; ⅝-in., 16,000 lb; ¾-in., 25,000 lb; 1-in. 40,000 lb.

FIGURES SHOWN are for average pull-out values, and do not include a factor of safety. A 15 percent variation from these figures may be expected under field conditions. Values are based on anchors set with not more than 6 in. of the rod exposed, at an angle of 45 deg or greater. Anchors set at shallower depths will decrease in strength approximately 15 percent for the first foot and 10 percent for the second foot, other things being equal. Greater than 15 percent strength variations can be expected at shallower depths. Soil classification selected should be that corresponding to most unfavorable conditions.

Table II—Anchor Application Table

Anchor Type	Soil Classification 1	2	3	4	5	6	7	8	Soil Condition Rocky	Small Stones	Roots
Rock	x	x									
Cone		x	x	x	x				x	x	x
Plate			x	x	x	x	x			x	
Expanding				x	x	x	x			x	
Screw					x	x	x			x	
Swamp								x			

TYPICAL FIVE- AND SIX-ROOM HOMES comprising the test group. All use electricity for cooking, water heating and space heating. Each of these small houses is insulated and has a basement-enclosed garage

Electric Heating Means High Costs

A. W. AMES,
Seattle City Light, Seattle, Wash.

Experience in the Pacific Northwest coastal area with 100 percent saturation furnishes revealing data on controversial subject of heating houses with electricity

SEATTLE CITY LIGHT has heated 33 five- and six-room houses electrically for over a year. These houses, designed and built for electric heating, are all on one primary feeder for metering with no other load.

The houses are insulated, walls and ceilings, but have no weather stripping. Full basements enclose garages. Unit-type electric heaters are located in each room, thermostatically controlled. One heater is in the basement. Each house also has a fireplace.

These houses are 7,500 and 8,000 cu ft in volume, and form a "U" down one street, across and up another street. The houses line both sides of the streets. The primary is a closed loop around the block with the secondary services supplied by five 50-kw transformers distributed and banked. Each house has a 15-kw heating load and a 14-kw domestic load for a total of 957 kw connected. The maximum demand on the group was 330 kw, or 10 kw per unit average. Since this occurred in January, 1947, it is not included in the 1946 tabulation shown.

The primary meter was for this record only. Each house has an individual meter and the bills are figured on the residential schedule. These homes were built in the summer of 1945, and were occupied through October and November of that year. December, 1945, was the first full month of normal use. The unit average consumption for December, 1945, was 3,341 kwhr. This is 14 percent higher than any succeeding month. The later reduction is attributed to the economies and conservation that were subsequently practiced.

A comparison of daily load curves shows that the curve for a residence with electric heating is practically identical in shape to the system daily load curve, especially in the winter months. Thus heating adds to the morning and evening peaks, reducing the load factor. The heated residence daily load factor is less than the system daily load factor in the heating season, 45 percent and 65 percent respectively. This is much more pronounced when considering the annual load curve with annual load factors of 23 percent for heated homes and 50 percent system annual load factor.

House Heating Undesirable

House heating is not regarded as desirable load by many agencies in the Pacific Northwest coastal area. The reasons for this do not necessarily apply to other sections of the country. Hydro power systems depend upon melted snow in the mountains. This, of course, is frozen in the winter at the season of highest peaks. Later in the year when the load drops off, the supply of water increases. Dams give control of this

flow but not in amounts proportional to the seasonal variations. For example, the load increase in 1946 exceeded all expectations. Construction of additional storage and generating facilities could not keep pace with this rapid load growth. Cool summers with considerable rain eliminate air conditioning and irrigation as summer loads. There is no sizable summer load worth promoting.

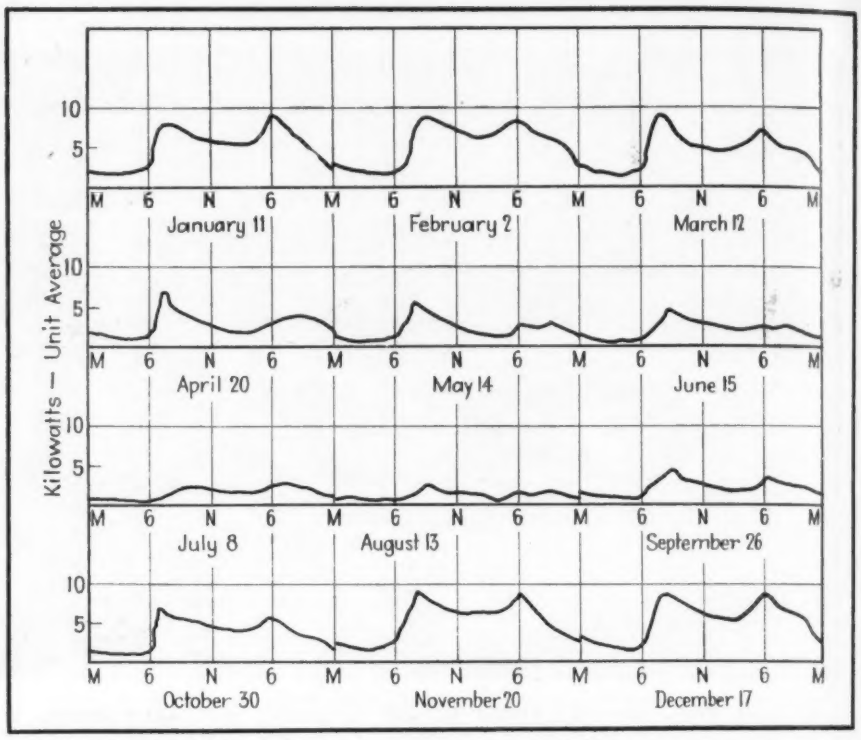
Rates and resulting revenues are closely related to load factor. A block rate for residence service is the universally accepted practice. The load factor feature is used for the three types of residence load: Lights only, lights with cooking, and then with water heating added. Electric heat constitutes a fourth type of load for which provision must be made.

Calculations determine the kilowatt capacity needed to supply the necessary heat units. Tests have established the kilowatthours required and the maximum demand for unit average house heating. With the necessary revenue per kwhr determined, the rate per kilowatthour for house heating can be calculated. For example, if $40.00 per kwyr is required, then for 7.5 kw on 14,000 hr the cost is 2.14 cents per kwhr.

In purchasing power for distribution, the rate must equal the wholesale cost plus cost of delivery and collection. At the wholesale rate of $17.50 per kwyr, house heating on a 20 percent annual load factor costs 1.0 cent per kwhr. Allowing 1.1 cents per kwhr for distribution, metering, billing, etc, the minimum revenue for electric house heating is 2.1 cents per kwhr.

Applying this rate is a problem in itself. If the same line of reasoning which established the usual three steps in residential block rates is followed, this heating rate should form the fourth step. The number of kilowatthours to start the heating block will vary with the utility. It will depend upon its particular average usage, as will the actual figure of the rate itself.

The accompanying tabulations are actual figures as metered and billed. No adjustments, allowances or estimates of any kind have been made. Maximum demands are the peaks of the year. The highest demand does not always occur during the period of greatest consumption.



ANNUAL LOAD CURVE for 1946 showing maximum load-days for each month. Chart is for 33 all-electric homes with heat metered on one primary feeder

TABLE 1—1946 Record for 33 All-Electric Homes with Heat. 7,500 and 8,000 cu ft each

Month	Kilowatthours		Max Demand		Load Factor %	Revenue	
	Total	Unit Average	Kw Primary	Unit Average		Total	Unit Average
January	96,550	2,925.75	300	9.09	44.8	$782.97	$23.72
February	94,360	2,859.39	294	8.91	44.3	740.72	22.45
March	79,120	2,397.58	303	9.18	36.3	635.42	19.26
April	57,520	1,743.03	234	7.09	17.2	479.58	14.53
May	30,160	913.94	180	5.45	23.3	283.72	8.60
June	23,990	726.97	141	4.27	23.6	242.72	7.36
July	17,670	535.45	78	2.36	17.5	200.98	6.09
August	18,270	553.64	84	2.55	19.6	202.03	6.12
September	30,480	923.64	132	4.00	32.0	283.43	8.59
October	49,530	1,500.91	240	7.27	28.8	416.87	12.63
November	86,610	2,624.55	300	9.09	40.1	702.61	21.29
December	96,145	2,913.48	288	8.73	46.4	776.09	23.52
Year	680,405	20,618.33		9.18	25.64	$5,747.14	$174.16
Unit Avg Month		1,718.19					14.51
Dom. Use, Unit Avg Yr		6,534.54		2.46	30.32		73.26
Dom. Use, Unit Avg Mo		544.55					6.11
Heat only, Unit Avg Yr		14,083.79		6.72	23.92		100.90
Heat only, Unit Avg Mo		1,173.65					8.41

Annual revenue per kilowattyear
Heat and domestic use $18.97
Domestic use only 29.78
Heat only 15.02

Note: The means of July and August values are taken as domestic use each month

TABLE II—Residential Load Characteristics Unit averages from actual operations during 1946. 100 percent saturation on each load type group. Meter on primary of each group

UNITS		Kwhr		Kw			REVENUE			
Load Type	No.	Year	Mo	Avg	Max	Load Factor	Year	Month	Kwhr	Avg Rate
						%	$	$	$	¢
Light and Appliances	200	1,324	110	0.1507	0.450	33.49	35.04	2.92	77.87	2.655
Light, Range Appliances	868	2,996	250	0.3425	0.1275	26.86	61.20	5.10	48.00	2.040
Water Heating Added	1,300	10,654	888	1.2164	2.498	48.70	101.04	8.42	40.43	0.948
And With Heat	33	20,618	1,718	2.3534	9,180	25.64	174.16	14.51	18.97	0.845

Note: The unit average of 26,000 all-electric (light, range and hot water) accounts was 8,057 kwhr for the year, or 671 kwhr per month, and $83.80 for the year or $6.98 per month revenue.

JOB EVALUATION . . .

Still On Trial

Is job evaluation worthwhile?

Results of *Electrical World's* survey of job evaluation in electric utilities reveal that unions and management accept . . . but do not enthuse over . . . this production tool

BETWEEN a quarter and a third of all electric utility employees are classified under some kind of job evaluation plan. An ELECTRICAL WORLD survey, made to determine how extensively job evaluation has been adopted and how it is applied in electric utilities, reveals 84,916 employees so classified. Employment in the industry is now approaching 300,000. Thus it appears that job evaluation has much more than just a good start as a means for rationalizing wages and salaries with work performed.

Survey questionnaires were mailed to operating heads of 712 electric utilities. Replies came from 206, a response of about 30 percent. For a mail survey, this is a high return ratio, indicating much interest in the subject.

But this 30 percent ratio does not accurately measure the interest. A better yardstick is the number of employees represented by the 206 returns. Conservative estimate of this number is 220,000. Assuming, and becoming more conservative in doing so, that total employment is 300,000, the response ratio rises to over 70 percent.

Of the 206 returns, 153 reported no job evaluation plans in use. One-half of these "no plan" returns furnished information on number of employees. The total thus reported was 55,773. This justifies an estimate of 90,000 employees represented by all 153 of these returns.

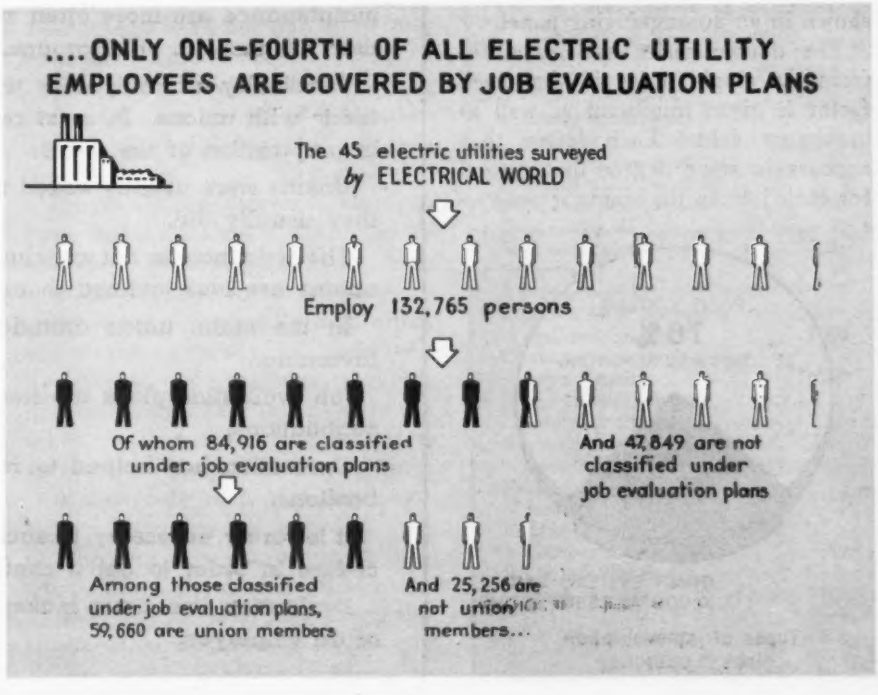
Evaluation plans were reported in preparation by 8 replies, leaving 45 cases of plans in use. Represented in these 45 returns are 132,765 employees. This number, plus the 90,000 estimated for "no plan" replies, gives the 220,000 stated previously as represented by all 206 replies.

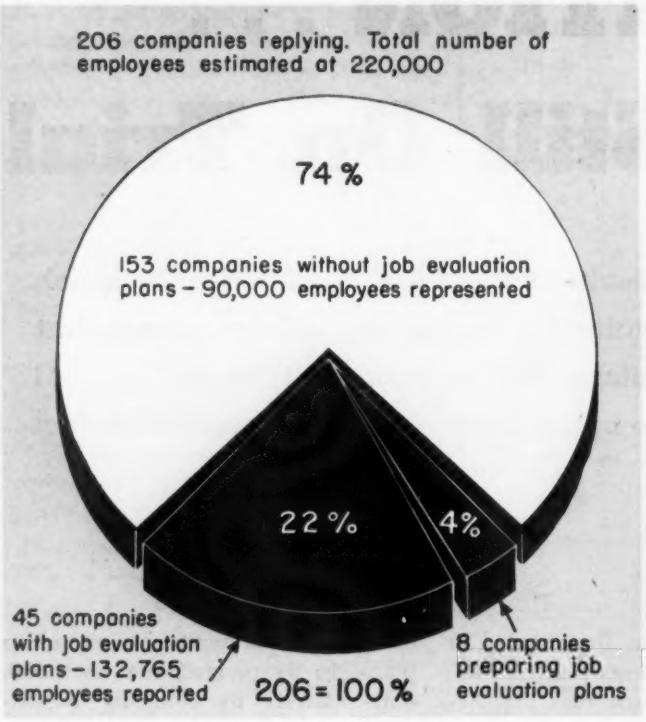
Of the 132,765 employees in utilities with job evaluation plans, 84,916 work in evaluated jobs. This figure represents between a fourth and a third of all electric utility employees. Of employees covered, 59,660 are under union contract and 25,256 are not.

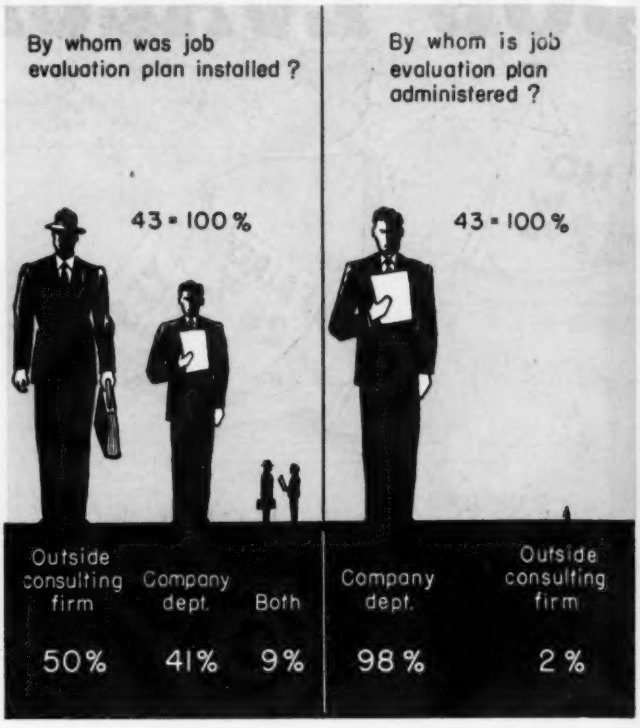
In half of the instances reported, job evaluation plans were installed entirely by outside consultants. In 9 percent, the consultants worked with company departments in setting up plans. In 41 percent, the work was done entirely by company departments. Administration of plans is practically all in the hands of company departments.

Methods of job evaluation are diverse. Point systems are usually most favored. But other methods are: Comparative job ratings; job definitions in consultation with union representatives; and applications of ratios to bases of previous years.

Single series point systems were reported in 18 replies, with total point values ranging from 58 to 2,250. Nine companies reported use of double series systems, minimum and maxi-


....ONLY ONE-FOURTH OF ALL ELECTRIC UTILITY EMPLOYEES ARE COVERED BY JOB EVALUATION PLANS
The 45 electric utilities surveyed by ELECTRICAL WORLD
Employ 132,765 persons
Of whom 84,916 are classified under job evaluation plans
And 47,849 are not classified under job evaluation plans
Among those classified under job evaluation plans, 59,660 are union members
And 25,256 are not union members...

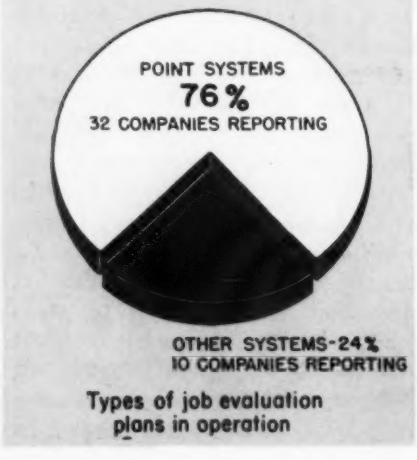

206 companies replying. Total number of employees estimated at 220,000
74 %
153 companies without job evaluation plans – 90,000 employees represented
22 %
4%
45 companies with job evaluation plans – 132,765 employees reported
206 = 100 %
8 companies preparing job evaluation plans



mum values of various magnitudes being assigned to the stated job factors. But numbers and designations of factors in both the single and double series systems are variable. Thus there is no common basis for comparison of systems.

Illustrative of the single series system is one totalling 500 points. This type was reported in 6 replies. There are some variations of statement among these replies. But it is evident they all refer to the same system. The factors and point values are shown in an accompanying panel.

The double series systems differ from the single series in that each factor is given minimum as well as maximum value. Each factor thus appears in some degree in the total for each job. In the single series sys-



Types of job evaluation plans in operation

IN SUMMARY, THE SURVEY REPORTS THAT:

Job evaluation plans are operating in about one-fourth of the replying utilities.

About three-fifths of the plans reported were installed by, or with the help of, outside consulting firms. But administration of the plans is almost entirely in the hands of company departments.

Point systems are favored over other methods of job evaluation.

Employees in sales, clerical work, plant operation and maintenance are more often covered by job evaluation plans than are those in other groups.

Practically all companies with evaluation plans have contracts with unions. In most cases the unions were consulted in preparation of the plans.

Unions were usually asked to agree to job evaluation. This they usually did.

The evidence is not conclusive, but it appears that UMW unions are less inclined to agree to evaluation than others.

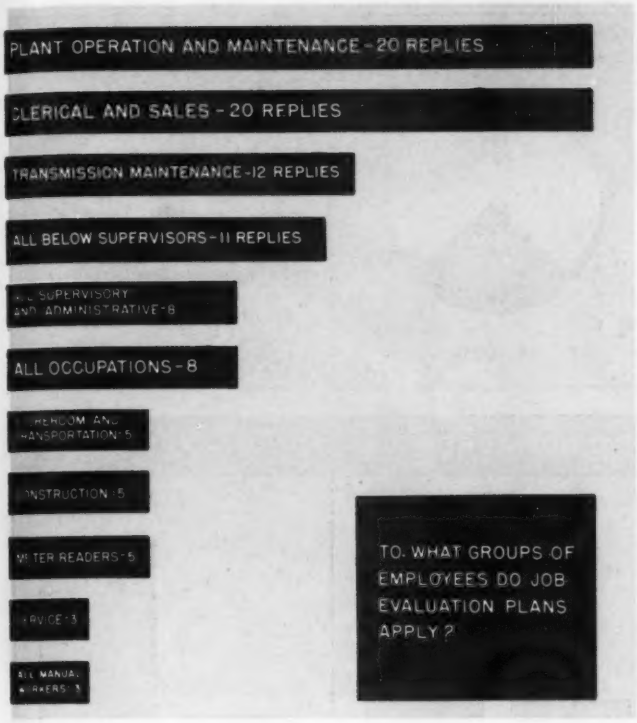
In the main, union attitudes towards job evaluation are favorable.

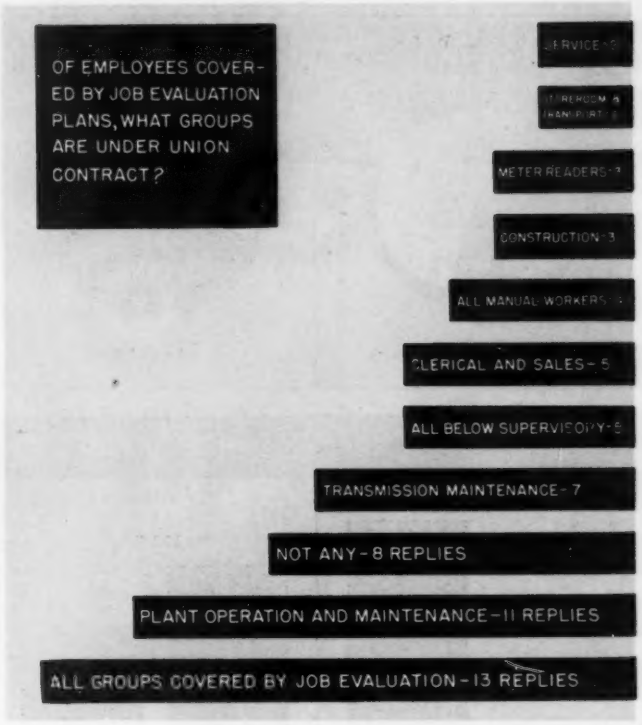
Job evaluation plans are frequently useful in union contract negotiations.

Evaluation has helped to reduce requests for job reclassifications.

It is rarely necessary to sacrifice sound job evaluation procedure in order to get a contract signed or a strike settled.

Evaluation sometimes makes it difficult to change the duties of an employee.


PLANT OPERATION AND MAINTENANCE - 20 REPLIES
CLERICAL AND SALES - 20 REPLIES
TRANSMISSION MAINTENANCE - 12 REPLIES
ALL BELOW SUPERVISORS - 11 REPLIES
ALL OCCUPATIONS - 8
TO WHAT GROUPS OF EMPLOYEES DO JOB EVALUATION PLANS APPLY?


OF EMPLOYEES COVERED BY JOB EVALUATION PLANS, WHAT GROUPS ARE UNDER UNION CONTRACT?
METER READERS - 3
CONSTRUCTION - 3
CLERICAL AND SALES - 5
TRANSMISSION MAINTENANCE - 7
NOT ANY - 8 REPLIES
PLANT OPERATION AND MAINTENANCE - 11 REPLIES
ALL GROUPS COVERED BY JOB EVALUATION - 13 REPLIES

tem, a factor can be assigned a zero value and eliminated.

In addition to the 27 replies reporting single and double series point systems, 5 others reported point systems in use. But these were left unspecified because of contracts with consultants or for other reasons. Of the total 45 replies, 3 were not responsive. Other methods were reported in 10 replies.

Clerical, sales, plant operation and maintenance employees were most frequently mentioned as coming under job evaluation plans. Manual workers and service employees were least mentioned. In only 7 instances was application of job evaluation to all employees indicated.

Union contracts covering some or all employees are in force in 90 percent of the companies reporting job evaluation plans. It would appear from this that union organization is a strong influencing factor in the adoption of job evaluation. This conclusion, however, receives little support from replies reporting no evaluation plans. Of these, 54 said the companies had union contracts and 35 said not. This is a contract proportion of 61 percent, neither low enough to support the conclusion, nor high enough to refute it.

Unions are generally consulted in setting up job evaluation plans. This is reported in a majority of the replies responsive on this point. But the majority is not large enough to justify the conclusion that consultations with unions are a prerequisite to successful job evaluation.

Unions are asked to agree to evaluation plans about 3 times out of 4. They agree in about the same ratio. Independent unions agree somewhat more frequently than CIO and AFofL groups. The returns indicate the UMW unions to be more recalcitrant than the others in regard to job evaluation. But the small number of times these unions were asked to agree prevents any such conclusion.

Attitudes of unions towards job evaluation are generally favorable. But several replies reported vigorous condemnation.

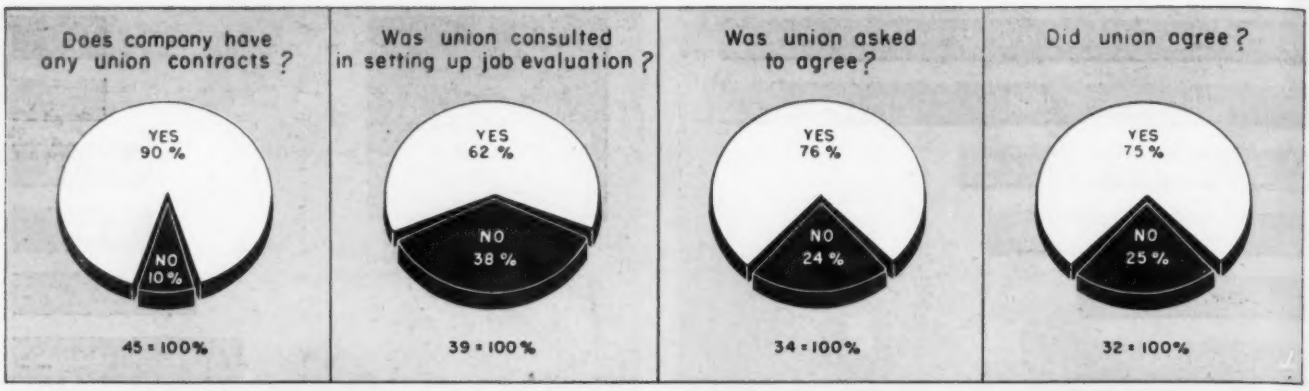
Job evaluation serves both as a basis for negotiation with unions and as an operation guide for management. It serves these two purposes together more frequently than either one singly. Generally, job evaluation is used only as a management guide in those cases where unions were not asked, or refused when asked, to agree to the plan. Conversely, where it is used only as a basis for negotiation, the union has helped to work out the plan or has agreed to it. Since companies find job evaluation useful in both purposes, a plan acceptable to the union would seem worthwhile.

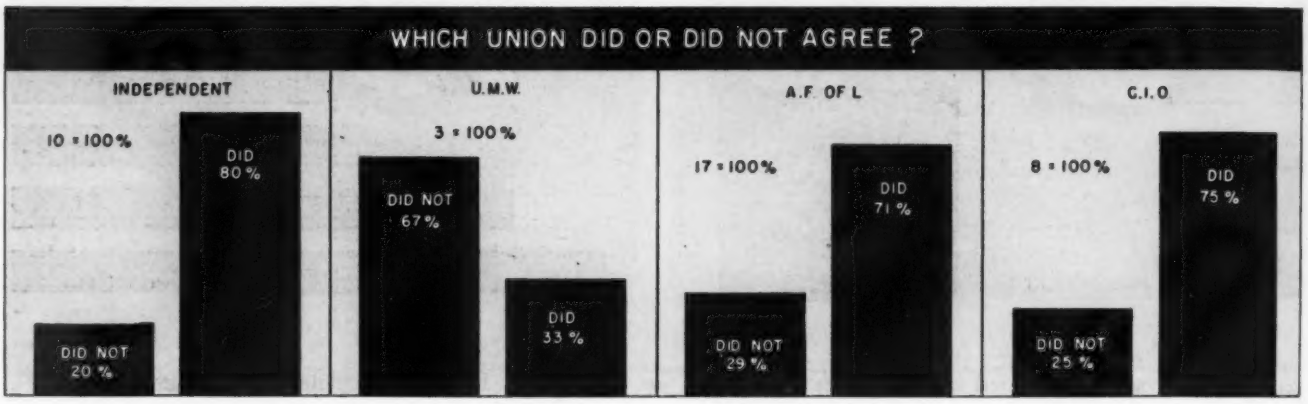
The usefulness of job evaluation is not confined to relations with unions. It helps reduce requests for job reclassifications from employees and unions. The evidence of the replies is 3 to 1 supporting this. This is testimony to the usefulness of evaluation to management.

No sacrifice of sound job evaluation procedure is required in negotiating union contracts or settling strikes. This is confirmed by 8 out

Factors and Values of a Typical Method of Job Evaluation

Factor Designation	Maximum Points
Previous experience required	40
Knowledge required	40
Physical skill required	20
Physical effort required	10
Complexity of duties	90
Seriousness of errors	25
Hazards	30
Adverse working conditions	10
Contacts with customers and general public	40
Contacts with other departments	10
Responsibility for safety of others	35
Responsibility for company funds or property	15
Responsibility for confidential information	15
Responsibility for unsupervised work	20
Responsibility for work of others	100
Total points	500



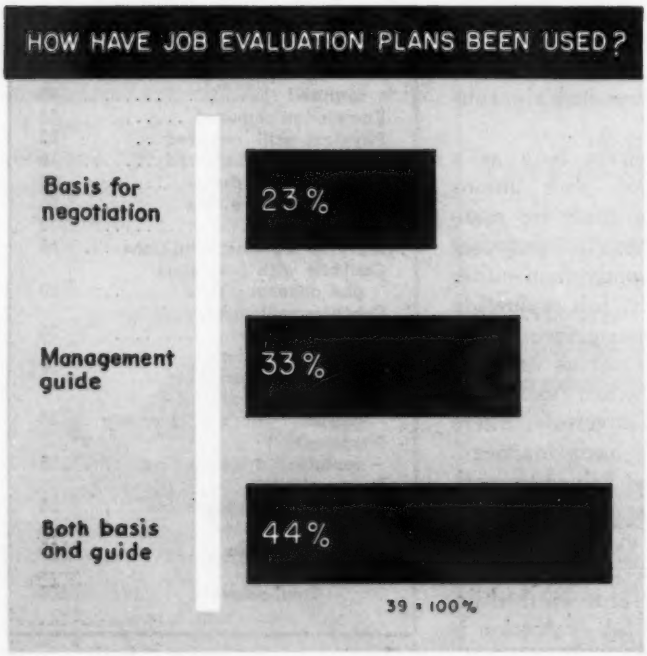


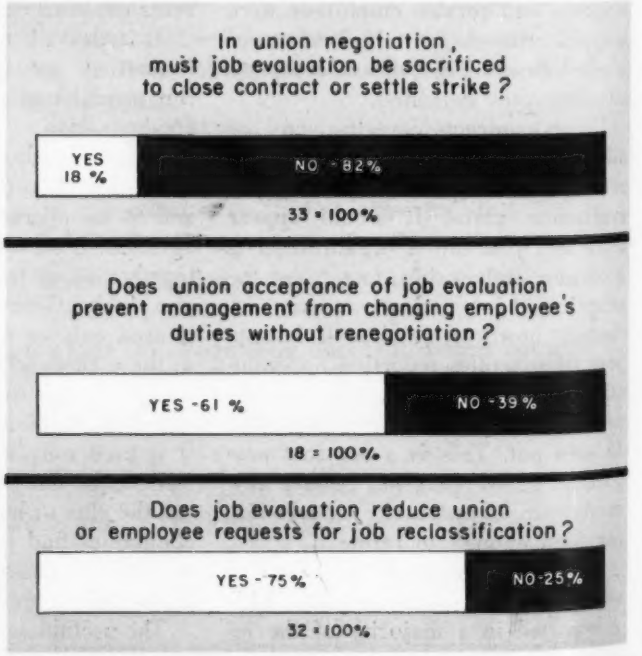
of 10 replies to this revealing question.

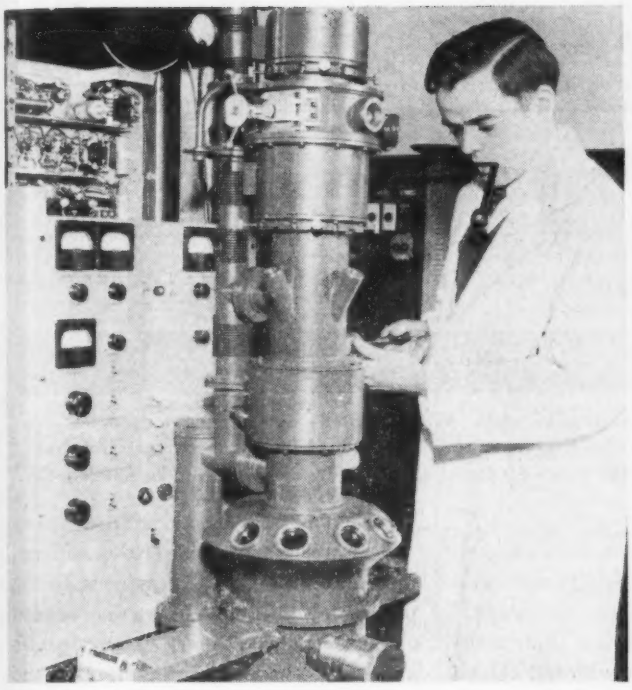
When a job evaluation plan has been accepted by a union, renegotiation will generally be demanded by the union if an employee's duties are changed. The number of replies on this point was quite small and perhaps does not justify such a conclusive statement. However, it is obvious from even so few replies that job evaluation introduces a certain rigidity into the direction of employee energies and over-all output. This in itself is not wholly bad.

Job evaluation is considered worthwhile. About 3 out of 4 replies gave it this rating. Only one of the 43 responding utilities found it of no particular advantage. "Fairly satisfactory" was the judgment of 11 of the responding companies.

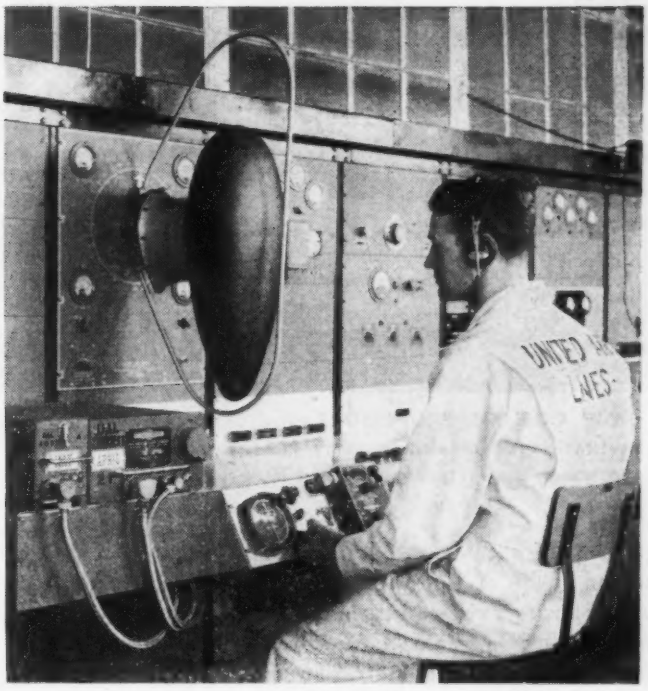
The list of companies to whom the questionnaires were sent was obtained from the McGraw-Hill Central Station Directory, dated 1946. In so far as possible, each questionnaire was mailed to the president of each company. If the name of the president was not listed in the directory, the name of the highest ranking official listed was chosen. Because of manifold differences in the various job evaluation systems in effect, some of the questions in the survey did not lend themselves to tabulation.




In union negotiation, must job evaluation be sacrificed to close contract or settle strike ?
YES 18 %
NO - 82%
33 = 100%
Does union acceptance of job evaluation prevent management from changing employee's duties without renegotiation ?
YES - 61 %
NO - 39 %
18 = 100%
Does job evaluation reduce union or employee requests for job reclassification ?
YES - 75 %
NO - 25 %
32 = 100%



RCA Photo



United Airlines Photo

GLAMOR JOBS like these in the light-current industries, particularly electronics, seem to draw young electrical engineering students. To the left, Dr. James Hillier, of RCA Laboratories, adjusts an electron microscope he designed. At the right, a young man tests a radio compass of the type widely used on U. S. transport aircraft

Has Electronics Eloped With Engineers?

Here's what one utility president discovered when he asked 50 engineering educators about the attitude of college students toward a career in the electric utility industry

ELECTRICAL ENGINEERING students in colleges today don't think very highly of the electric utility industry as a place to spend their working lives.

This, at least, is the opinion of responsible electrical engineering educators in about 50 of the nation's technical colleges and universities. Their feelings were made abundantly plain in a survey conducted last spring by President Elmer Lindseth, of the Cleveland Electric Illuminating Co.

"Electrical engineering students can see in other (than power) branches of the field very much higher stakes to play for in a fascinating and stimulating game, in which many of them can acquire important responsibility as soon as they can demonstrate the ability to carry it. The utility business looks drab by comparison."

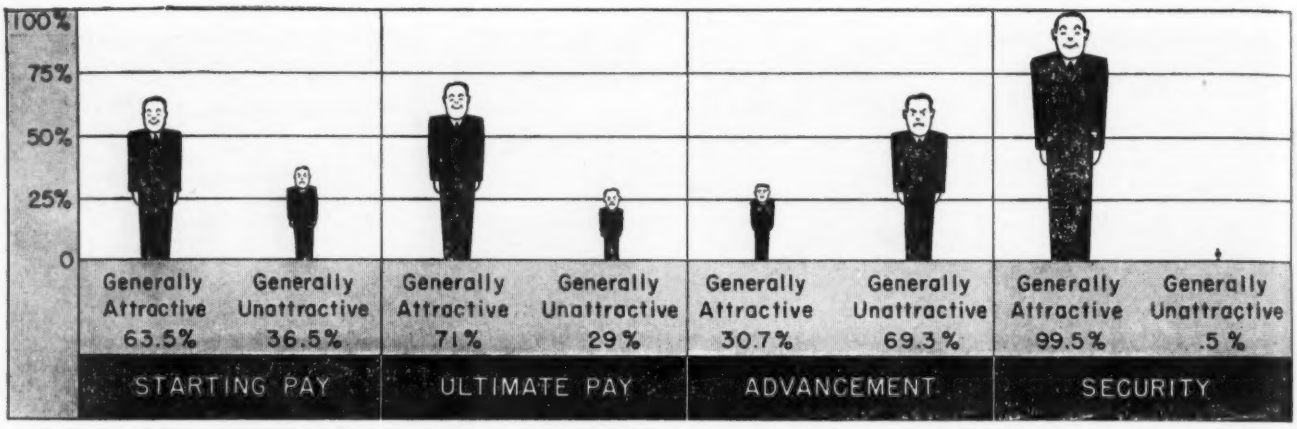
These are part of the sentiments of the top man in the electrical engineering department of one of the nation's finest technical schools.

Repeatedly, electrical engineering educators noted that the glamorized electronics and other light-current industries were taking the top men from their graduating classes. Generally, the college deans deplored this. But that the unpleasant fact exists, there was no argument.

A composite questionnaire, listing the results of individual questionnaires sent to 50 or more deans of engineering and electrical engineering department heads, shows the industry's position on the campus all too plainly. The educators were asked about the frequency with which a career in the electric power industry is considered by their students. Two found it "almost never" considered. Nineteen found it considered "very seldom." Twenty-one found it considered "frequently," and one answered "very often." That's a 50-50 split for and against the power business.

One dean of engineering submitted to his 17 senior electrical engineers the questionnaire Lindseth sent him. Then he submitted a composite return for them, composed from their answers to Lindseth's questionnaire. These men were then perhaps two months away from graduation and the opening of their careers. Four of them said they "almost never" considered the industry. Another seven said they "seldom" did. Six considered it "frequently," and none considered it "very often." Apparently, the educators were conservative in reporting their conclusions on this question.

Another general question on the same questionnaire showed even more



HOW COLLEGE PROFESSORS voted on the attractiveness or unattractiveness of electric utility industry pay scales, the advancement it offers young men, and its security is shown by this chart. The data were adapted from the questionnaire distributed last spring to electrical engineering educators by President Elmer Lindseth, of the Cleveland Electric Illuminating Co

striking results. It asked how those students who do consider the industry for a career regard its possibilities. Seven educators said their students found the possibilities "fair." Twenty-two believed their students found the power industry's possibilities "average." Ten more reported "better than average." Two reported them "outstandingly good."

Again, in answering this question, the 17 senior electrical engineering students who were polled by a Midwestern dean of engineering were less intrigued by the power industry. Six of them regarded the industry's possibilities as "fair." Eight of them found the possibilities "average." Three found them "better than average," and none considered them "outstandingly good."

Lindseth is careful to point out that he did not attempt to make a scientific poll of opinion. Still, people within the power industry have spoken for years of a diminishing interest in their business on the part of engineering students. And Lindseth's poll is evidence that the gossip of the years wasn't entirely wrong.

The answers to these two questions, incidentally, contrast sharply with the position the industry once occupied on the campus. Twenty or more years ago, electric utilities commanded the keenest interest of electrical engineering graduates. One dean of engineering noted this in answering his questionnaire. Prior to 1925, he said, the electric power industry was in the forefront of those considered by engineering graduates who were choosing a career. Since then, he went on, the picture has changed completely. Now the industry is seldom considered.

What is responsible for this reversal of sentiment? The educators noted several things in the letters some of them returned with their questionnaires. One of the bluntest says this, in part:

"... (utility) companies are placed at a distinct disadvantage with respect to industry in general because (1) the starting salary is and always has been too low; (2) advancement is slower with utilities than with other industries, particularly the manufacturers; (3) the type of work required of young engineers in the utilities is not technical enough to challenge the better student and keep him interested.

"Our better students are obtaining salaries this spring of $225 per month or higher and the ——— Co (electric utility) is offering the men a starting salary of $180. This is not enough to attract even the poorest student in our classes.

"We have more requests from graduates working in the public utility field than all other graduates put together for openings that will give

New Manpower and the Power Industry

MOST, if not all, of the difficulties now besetting the power industry are susceptible of resolution and will be resolved. There is, however, one danger that most power groups are heedlessly plunging into that is bound to give trouble and that is the very real danger of a loss of manpower, properly trained and equipped to man future executive and operating posts.

Inquiry among a group of engineering school heads reveals the astonishing fact that while they have placed most of their recent graduates, comparatively few of these are entering the electrical power industry. Meanwhile, time and technology march on. It is true there is as yet no lack of manpower, but the men on the firing line are in most cases being used harder than ever before. These men represent by and large the proportion of brain and manpower that the industry attracted and attached to itself one, two or three decades ago.

It may be difficult to justify the adding of new graduates on the payroll. But other men in the less skilled and trained groups have been added as a matter of necessity. The question is: Can the industry afford not to take to itself at least a fraction of its normal share of the year-to-year crop of trained brain and manpower? If it looks to its future, it would not appear so.

(ELECTRICAL WORLD, December 8, 1934.)

MANPOWER PROBLEMS in the electric utility industry aren't new. As the editorial reproduced above shows, manpower was a matter for industry concern 13 years ago

them a chance for rapid advancement. Most of these requests are from men between 30 and 40 years of age. These men have become dissatisfied with their advancement (salary and responsibilities) and write us about opportunities in other fields. I am not thinking about present conditions, as this sort of thing was prevalent before the war.

"When we place a man from the upper quarter of his class with a public utility, he is very enthusiastic at first, but his enthusiasm wanes in two or three years and then we hear from him. I usually encourage the man to stay with the company and talk frankly to his boss about the situation. Because of this situation, we do not encourage our best students to go to the utilities directly from college."

The appeal of the light-current fields also plays a large part in determining reaction of student electrical engineers to career possibilities in the power field. At least, the engineering educators say it does. Consider these comments:

"The present situation is such that the glamor of radar, television, jet propulsion and plastics have so distracted the students that the modest, conservative and realistic picture of employment in the electric utility industry has been completely overshadowed." (Head of electrical engineering department at an Eastern college.)

There are other reasons, as educators see the picture, why the electrical engineering student backs off from utility employment. A department head at a small Eastern school noted, "I think there is no question but that the treatment your industry received at the hands of the government has been responsible for a reduction of its prestige in the minds of impressionable youth."

He adds that "the active recruiting campaigns carried on by the telephone and electrical manufacturing industries have, I believe, for many years tended to give them an advantage in the competition for the best material in the engineering graduating classes."

One electrical department head at a small college noted laconically that "our seniors seem to be favorably impressed with opportunities in the Bell Telephone Co, but do not think so highly of the power industry."

QUESTIONNAIRE ON ATTITUDE OF MALE COLLEGE STUDENTS TOWARD ELECTRIC UTILITY INDUSTRY FOR CAREER

1. FREQUENCY WITH WHICH THE ELECTRIC UTILITY INDUSTRY IS INCLUDED AMONG THOSE CONSIDERED BY STUDENTS FOR A CAREER:

   Almost Never 2 Seldom 19 Frequently 21 Very Often 1

2. HOW DO THOSE WHO DO THINK ABOUT THE ELECTRIC UTILITY INDUSTRY FOR A CAREER REGARD ITS POSSIBILITIES?

   Fair 7 Average 22 Better Than Average 10 Outstandingly Good 2

3. PLEASE INDICATE WHICH, IF ANY, OF THE FOLLOWING ARE IMPORTANT FACTORS IN INFLUENCING THE STUDENTS' CHOICE OF CAREER, BY CHECKING OPPOSITE EACH SUCH FACTOR THE COLUMN MOST DESCRIPTIVE OF THE EFFECT.

FOR ELECTRIC UTILITY INDUSTRY	Often Sells Industry to Student	Reasonably Attractive	Tends to Discourage Some of Most Desirable Students	Responsible for Unfavorable Comparisons
Starting compensation	3	23	11	4
Ultimate compensation as gauged by salaries of present principal executives	3	24	7	4
Prestige expected to develop from a job in the industry	1	25	11	2
Possibilities for and speed of advancement	4	8	19	8
Business potential	6	21	4	0
Presence or lack of frontiers, opportunity for further industry development	4	23	14	1
Stability and security	20	17	1	0
Governmental interference			6	6

4. PLEASE CHECK THE FOLLOWING TO INDICATE THE KIND OF A JOB THE ELECTRIC UTILITY INDUSTRY IN GENERAL DOES IN SELLING ITS POSSIBILITIES FOR A CAREER TO THE STUDENT.

	Little or No Apparent Impression	Good Impression	Unfavorable Impression
In High School days or before	28	5	0
During College years	27	16	0
Through industry representative prior to graduation	17	25	1

A COMPOSITE RETURN for Lindseth's questionnaire sent to deans of engineering and electrical engineering department heads at 50 colleges and universities shows how educators answered each question

One professor, declaring that this whole subject is one "of real concern to the electrical engineering educators," takes a little of the blame on his own profession. He says:

"In schools, power people tended to be older and more conservative, less adventurous intellectually than those who went into the communications field. Fifteen years in the dog house probably has not helped utilities, either."

But he continues:

"More recently, as utilities have begun sending personnel people to the schools after a lapse of 10 or 15 years, their appeal has not always been such as to stimulate the able group (of students). The personnel man from one utility, normally regarded as distinctly progressive, emphasized the security and stability that his company had to offer in spite of the not-too-high salary. He pointed out that there were responsible jobs for able fellows; but that there was necessarily a long period of waiting, about which not much could be done, before such responsibility would be given to a young man. In other words, his company offered a fairly slow-moving, no-risk job in which, if a man did well, he could expect eventual recognition. Electrical engineering students can see in other branches of the field very much higher stakes to play for in a fascinating and stimulating game in which many of them acquire important responsibility as soon as they can demonstrate the ability to carry it. The utility business tends to look drab by comparison."

Lindseth points out that the industry's present and future expansion will create a great demand for young men of executive caliber. And he believes that the industry can obtain them.

"Let us take a look at our incentives, and at our development and training programs, to make sure that we really do provide a good future to outstanding young men, and then let us beat the bushes at the nation's colleges and universities to attract more young men of this caliber. And let us do a full-dress job of making a favorable impression on youth and on our communities," Lindseth says.

"This is a job not only for single companies, but for the industry. Let us re-sell schools on the future of our industry. We can benefit by acting immediately and together."

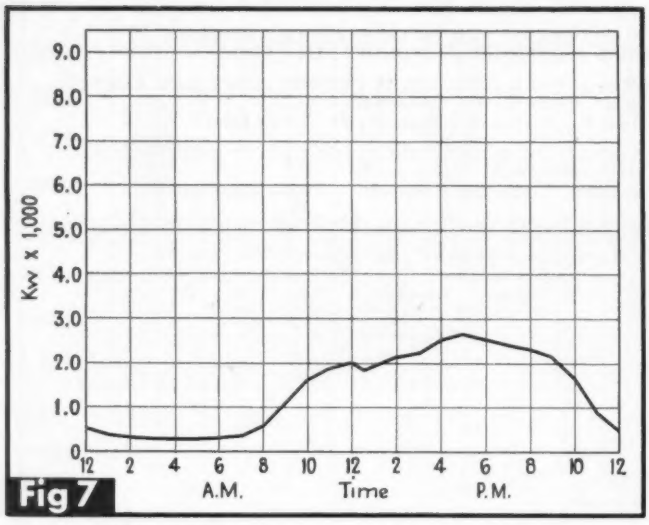


Fig 7

ESTIMATED RETAIL power and light load in a community of 10,000 domestic customers

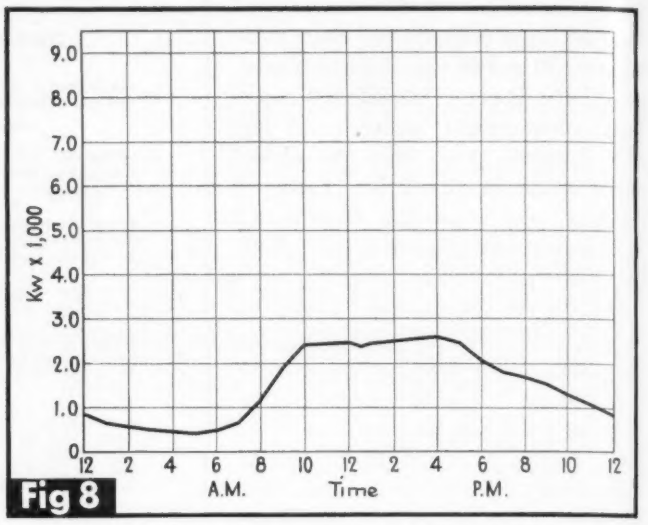


Fig 8

PROBABLE SHAPE of large commercial load (10,000 domestic customers)

Diversity Factor Underlies

H. E. CAMPBELL
Power Distribution Division
General Electric Co
Schenectady

Over-all system load derived by adding retail commercial and industrial power to diversified residential load for a community of residential users . . . This affords a basis for selective increments

WHEN the residential load is viewed through the primary feeder, there are probably enough customers to give the benefits of maximum diversity. The per customer demand would be as shown in the accompanying curves. Usually, there will be several primary feeders from a substation to different parts of a residential community. Living habits are different in the various localities. Thus another factor, intergroup diversity, is applied to the diversity factors shown in Fig 4 (preceding installment). A good figure for this intergroup factor is 1.08 for one class of load, either residential or commercial.

Load Curves

Daily load curves for other classes of load can be obtained in a similar manner. The curves should be easier to plot because the demands are usually available from billing records and special tests do not have to be made. The general shape of the daily load curves at time of yearly system peak is shown in Fig 7, 8, and 9. These are for retail power and light, large commercial, and industrial classes of customers respectively. The curves are essential in studying the diversity between classes of loads at the substations and generating stations.

The following example shows how some of these basic data can be used in system study. For simplicity, it is assumed there is no intergroup diversity and there are no system losses. Once a method of approach is derived, these items can be considered separately.

Fig 10 shows the different class load curves which might exist in a hypothetical system. This system serves a community of 10,000 residential customers with 50 percent saturation of electric ranges and no electric water heaters. When totaled, these curves give an over-all system load curve back at the generating station, or at the point where energy might be bought for the system as a whole.

Suppose it is desired to know how the load curve will be affected if electric water heaters are added to the system. Any quantity could be considered, but 25 percent saturation will be taken for this discussion. Consider that the diversified per customer demand for the water heater is as shown in Fig 3. This load curve for 2,500 customers will add directly to the residential and total load curves of Fig 10 as shown by the dotted lines in Fig 11.

Analysis of the resultant curve shows that approximately 10 percent demand is added at the generating station when the water heater load is taken on. A 24 percent increase in demand is also noted on the primary feeders and substations supplying residential loads.

Water Heaters

Electric water heaters are storage devices if constructed in accordance with NEMA standards. Thus, if the proper size heater is installed it can be turned off for periods of time without affecting the hot water supply. Assume that standard twin-element tanks will be applied to this system and that the bottom element

* This series began in ELECTRICAL WORLD, September 27, 1947, page 66.

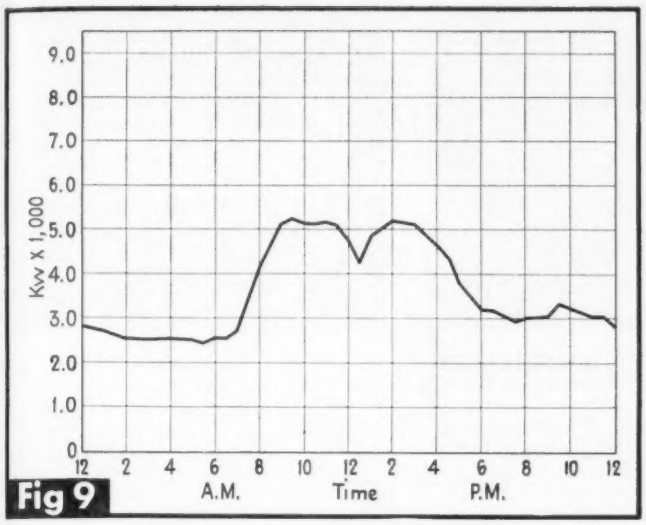


Fig 9

ESTIMATED SHAPE of industrial load (100,000 domestic customers)

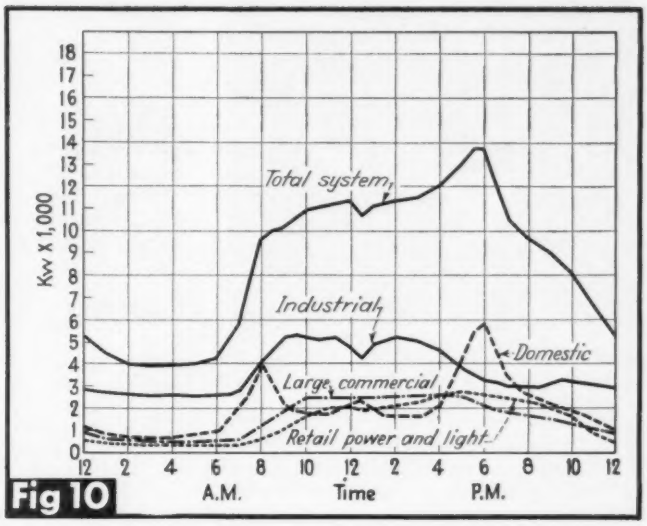


Fig 10

APPROXIMATE TOTAL system load for hypothetical community (10,000 domestic customers)

Economical Design . . . II*

will be turned off from 4 pm to 8 pm. The diversified per customer daily demand curve might have the shape shown in Fig 12. The dashed curve in Fig 11 is the resultant system load curve when controlled water heaters are used. This shows the benefits that accrue when the water heater load is kept off the generation and substation peaks. It will be seen that the peak demand is increased only slightly when controlled heaters are used. This increase in the peak demand is caused by the top elements operating during the off period.

There are other things to observe in Fig 11. The load at the supply point just before the water heaters are turned off approximates closely the peak load (6 pm) after the heaters are off. Also, the 8 am peak at the residential substations is close to the 6 pm peak without water heaters included. This indicates that no more controlled water heaters can be added without causing a new peak. The example has been set up with one water heater for every two ranges; that is, 25 percent saturation of water heaters and 50 percent saturation of ranges. This illustrates why several utilities have promoted a 2 to 1 ratio of ranges to controlled water heaters in order to avoid the creation of a new and undesired peak.

Hypothetical Systems

The curves and conclusions in this paper do not apply to any particular system; they are general. But the information can be a useful tool in determining economical distribution system requirements. Diversity is a key to more practical and economical design.

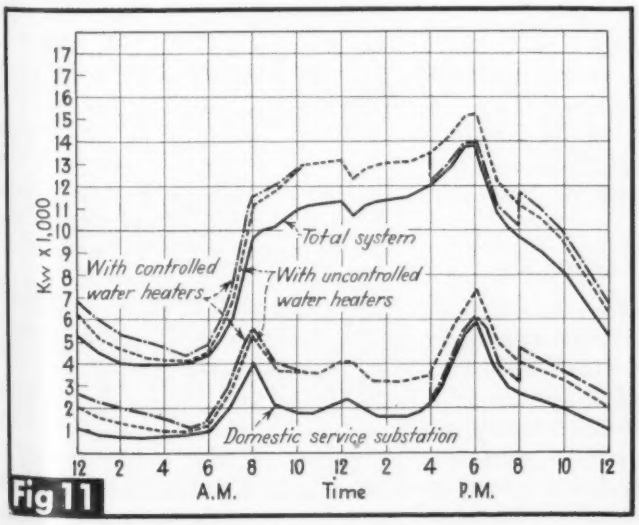


Fig 11

TOTAL HYPOTHETICAL system load with controlled and uncontrolled water heaters (10,000 domestic customers)

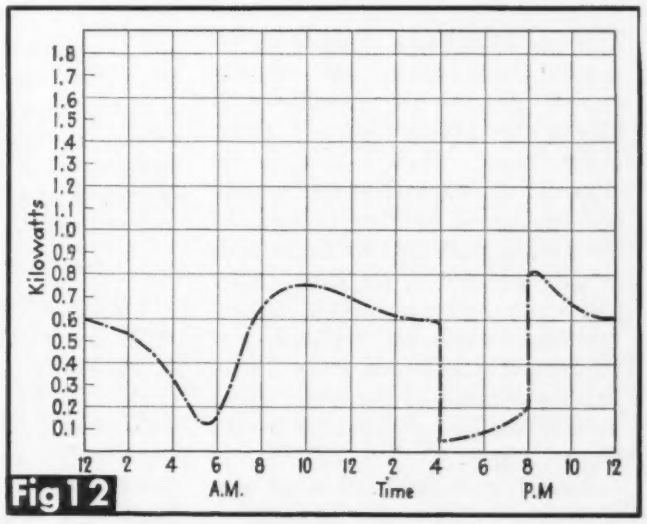
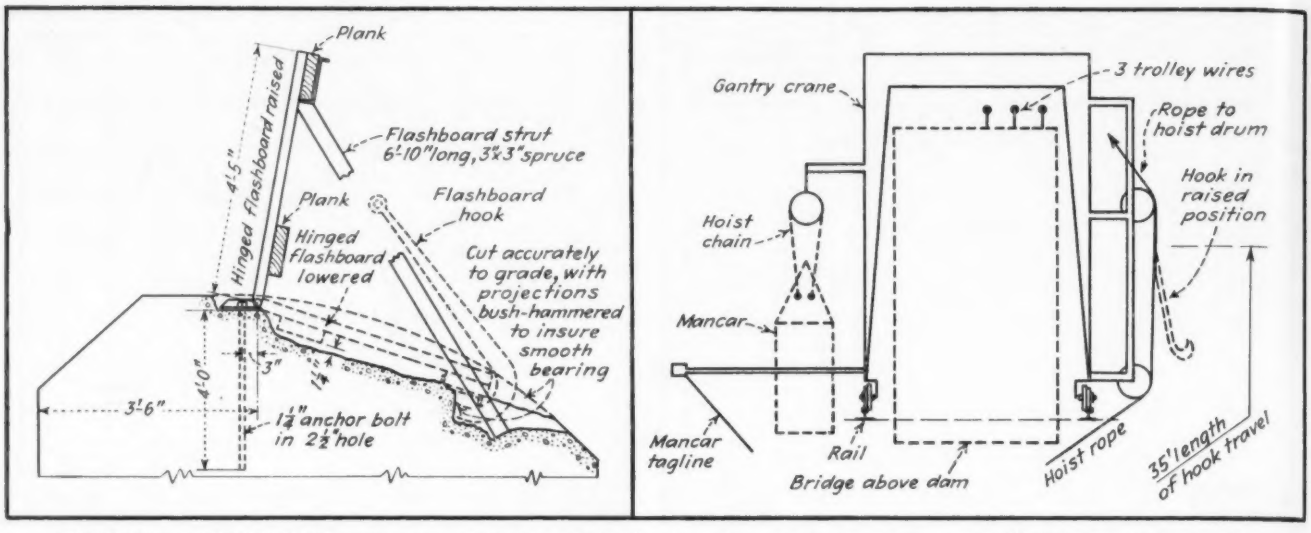


Fig 12

DIVERSIFIED per-customer demand, water heater load, off-peak control (340 kwhr per month)



SHAWMUT STATION DAM section through flashboards (left) showing hinge and seating arrangements, strut and hook positions. Struts are easily removed or replaced while raising or lowering panels by gantry crane (right). Recessions in dam prevent damage from ice and debris when panels are down. Crane travels 50 fpm and is driven through reduction gearing

New Flashboard Improves Flood Control

Hinged panels, crane-operated, assure free flow of excess water and drastically reduce replacement costs

HINGED FLASHBOARDS have been installed for 377 ft along the reduced crest of Central Maine Power's Shawmut station dam on the Kennebec River. Advantages claimed for this installation include: A reduction of high-water hazards, greater safety in operation, and the elimination of losses of old-type boards. These losses often reached an annual outlay of $2,200, since replacements of flashboards, pins, and brackets were necessary in varying degree from one to five times a year at this station.

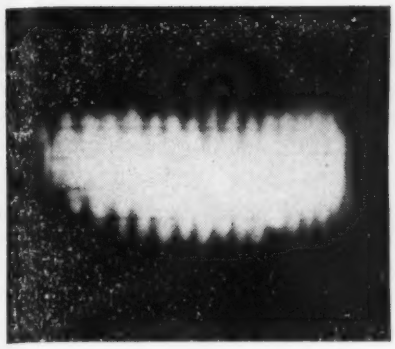
Each section at Shawmut station dam has a discharge capacity at full pond of about 140 cfs. Before spring run-off, all gates are opened and all hinged flashboards dropped by a gantry crane. With this discharge capacity, the water level can be held low enough to facilitate removal of the conventional type of flashboards at the other end of the dam. After high water returns to normal, the conventional boards are replaced, and the hinged boards and gates closed. For the balance of the year, under normal conditions, control is by the hinged boards.

According to A. F. Howard, mechanical engineer at Shawmut, a minimum head of 2 ft had to be maintained above the dam's crest as much of the time as possible during the reconstruction. Piers were extended to support a steel bridge above and parallel to the dam, thus enabling a 4-ton gantry crane to operate the new flashboards. This crane travels 50 fpm and is driven through reduction gearing by a 1.5-hp, 3-phase, 220-v motor. The flashboard hook hoist has a lifting speed of 5 fpm, and is driven through gear reducers by a 3-hp motor. A man-car with a hand-operated hoist of 2-ton capacity is included in the handling equipment. A 3-man crew is all that is required to raise or lower the hinged boards.

Flashboard Construction

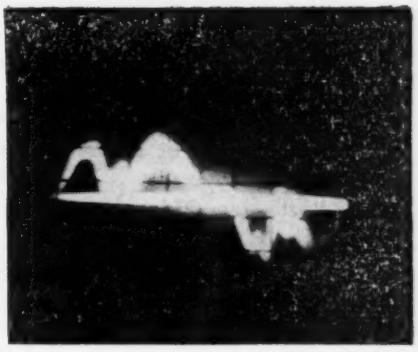
The new flashboard system consists of 72 oak panels, each measuring 4 ft 6 in. high, 5 ft wide, and 2.5 in. thick. Hinges and straps are iron. To hold each panel in normal operating position, one strut is used as a brace from the panel top to a recess in the dam. These struts can easily be removed or replaced while raising or lowering the panels. To avoid damage from ice and debris when panels are down, the dam was recessed from 3 to 12 in.

Nearly 2.5 miles of cutting by wagon drills was required to remove about 90 cu yd of concrete in making the installation. Special jigs were constructed for use with pavement breakers to finish the cutting to the desired grade. To facilitate the work, a surplus Navy barge was used as a floating workshop and supply depot. This eliminated the need of building costly and hazardous falsework from the shore. Pier noses were built with the aid of reinforced concrete forms that were made up on shore and placed on the up-stream face of the dam by the barge. Cables around the forms held them in position while the joints between the dam and the form were caulked with lead wool and oakum. The water inside the form was then pumped out, the form greased, and filled with concrete to which a quick-setting agent had been added. After the concrete had set, the cables were cut and the concrete shell dropped into the water.

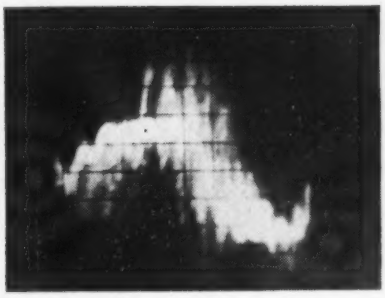


15-KV INSULATOR with cracked post. Excessive transient discharges are also revealed in this oscillographic study of insulating materials. The cathode-ray oscilloscope is excellent for detecting small currents, variable currents, and hidden losses in insulation

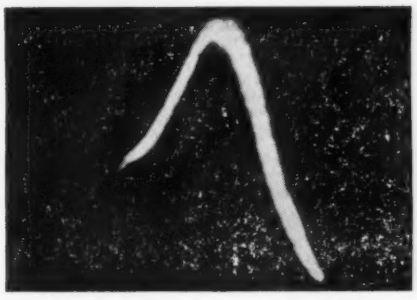
TRANSFORMER 15-KV cable pothead. Oscilloscope showed severe transient discharges although the wattmeter and power factor readings indicated good insulation. Magnifying glass was needed to find a fine longitudinal crack in the porcelain member



BUSHING for 73-kv transformer rejected by waveform only. Power factor and wattmeter readings were normal. Moisture was found in the compound filler; also a defect of the porcelain at the lower clamping-ring below the cement seal



OIL CIRCUIT-BREAKER bushing for 73-kv. Oscilloscope testing showed a cracked porcelain. Transients, also revealed, can be clearly seen in this photograph



INSULATOR section rated at 33-kv. Oscilloscope revealed a cracked support. Excess resistance-loss current results in a wave with sharp peak. The half-wave view is shown in this photograph

DEFECTIVE lightning arrester on a 15-kv transmission line. Oscilloscope indicated that arrester discharged at 6 kv, therefore was a potential hazard and a source of unexplained radio interference

Oscilloscope Broadens Insulation Tests

LIGHT-WEIGHT portable, 3-in. cathode-ray oscilloscope of the type used in waveform study

Departures in wave form revealed by oscilloscope often indicate insulation weaknesses not disclosed by conventional test data . . . Insulation rejected on waveform alone

ROLAND BLACKWAY
Operating Maintenance
Philadelphia Electric Co

THE BEST single test on insulation in the field is the power factor test. Supplementary application of an oscilloscope in insulation testing does not replace the power factor test but provides additional information with special reference to the low or variable losses.

In making a power factor test on any apparatus, the oscilloscope waveform can be used as a deciding factor when the test values are on the boundary line for acceptance or rejection.

Over a three-year period, power and instrument transformers, bushings, circuit breakers, lightning arresters, cables, potheads and oil samples have been studied on the oscilloscope.

The cathode-ray oscilloscope is excellent for detecting small currents and variable currents and for detecting the so-called "hidden losses" in insulation.

Of the total number of bushings rejected last year through the use of an oscilloscope in connection with routine power factor testing, 12.0 per-

cent were rejected on waveform only.

This waveform study was made along with routine power factor testing; therefore it was very convenient to use the Doble unit as the supply circuit. The Doble Set is a current meter, wattmeter, 10-kv, 60-cycle instrument. By connecting the oscilloscope to the supply side of the current circuit of the wattmeter, the current wave variations are readily obtained with 10 kv (or less) applied to the apparatus under test.

The oscilloscope was so connected as to indicate a function of the current rather than a voltage function. This is accomplished simply by connecting the vertical plate amplifier of the oscilloscope to the supply side of a resistance in series with the load circuit. The oscilloscope and one side of the test specimen is grounded.

The oscilloscope detects the minute or variable low insulation losses and the wattmeter detects the high and sustained losses. An oscilloscope can detect an insulation defect a year before it would be detected by wattmeter or power factor test.

Draw-Lead Open

One unusual subject, rejected by oscilloscope waveform only, was a 73-kv transformer bushing. The waveform was irregular and transient discharges were observed on the waveform as 10 kv was applied to various points on the bushing porcelain with the bushing stud grounded. This bushing was removed and at the repair shop tested only 2.1 percent power factor. Upon disassembling this bushing, the draw-lead conductor through the bushing center tube was found burnt and there were arc marks along the tube. The bushing was cut in half to investigate this unusual condition. One side of the heavy copper center tube was burnt away for a 12-in. length, and the paper core of this area was carbonized to a depth of 2 in. The draw-lead conductor was completely burnt open and the load current was carried by the carbonized path. This bushing was an unusual operating hazard and was detected in location by oscilloscope waveform study only.

Other disclosures are indicated by the accompanying oscillograms.

Interviews Aid Customer Relations

Customers interviewed are given the opportunity to make voluntary comments . . . Conversation avoids questionnaire approach

CHARLES G. KING
Supervisor, Consumer Research and Relations Division
The Cleveland Electric Illuminating Co
Cleveland, Ohio

CONVERSATIONAL INTERVIEWS with customers are helpful in building friendships, reducing complaints and determining company policies. This is proven by continuous consumer research and relations operations conducted by our company.

In contrast to the usual interrogative interview, the conversational type uses direct questions only to encourage voluntary comments and guide thinking. The conversation also gives the interviewer an opportunity to answer questions and to explain adverse comments. As a result of these conversations, management has a better understanding of customers' opinions, problems and requirements. Since January, 1944, when we adopted this polling practice we have obtained the desired results from it.

Organization for Interviews

A schedule is arranged that permits various groups of customers to be interviewed each month. For instance, in Cleveland, the metropolitan area has been divided into certain tracts and economic tenths. This has been done for census and statistical pur-

CONSUMER RESEARCH AND RELATIONS

DAILY SUMMARY

Date 9-15-47 Economic Tenth 2-3-4 District Cleveland Census Tracts C-9, D-4, H-5

PERIOD	CALLS		RESIDENTIAL CUSTOMERS INTERVIEWED				COMMENTS MADE BY RESIDENTIAL CUSTOMERS			REQUESTS OF RESIDENTIAL CUSTOMERS ***		Name Address Revisions Requested by Residential Customers
	Residential	Gen. Com.	Total	Making no Comments	Making Favorable Comments Only	Making Adverse Comments and/or Complaints	Favorable	Adverse *	Complaints **	Want Meter Outside	Other	
Today	74		53		46	7	117	3	4	1		6
To Date This Month	988		666	1	583	82	1,519	67	27	11	11	68
To Date All Tenths	98,452	341	60,848	307	50,167	10,374	113,820	8,579	3,542	1,239	811	5,221

* ADVERSE COMMENT: Something which the interviewer or planned to the customer's satisfaction.

** COMPLAINT: Critical comment reported to other departments

*** REQUEST: Action requested or desired by customer

ANALYSIS OF COMMENTS

	Today	TOTALS TO DATE This Month	All Tenths
Favorable Comments			
Bi-monthly Billing	1	17	4,303
Collection Policy	1	10	1,318
Prefer C.E.I. Service to M.E.L.P	2	11	2,382
Other	113	1,481	105,817
Adverse Comments			
Bills Seem High	1	19	2,638
Rates Seem High		5	769
Bi-monthly Billing			3,636
Collections and Billing		1	463
Other	2	40	1,093
Complaints			
High Bills		9	1,013
High Rates	1	4	623
Collections and Billing	1	2	70
Other	2	12	1,588

CUSTOMER COMMENTS are tabulated and analyzed daily. Reports of significant interviews are sent to all members of the company's executive staff. Reports that require immediate action are routed to the department heads concerned

poses. Each economic division is based on rentals or rental equivalents. All economic tenths are included in the survey each month.

Interviewers call at every home in the sections being canvassed. They are provided with the customers' names and addresses from the meter records. These are typed on the individual cards that are used for the interview report. Calls were made at 96,000 homes during the first 43 months of this operation. Interviews were had with 59,000 customers found at home.

The men selected as interviewers must have a sincere interest in people. This is necessary because they must converse with persons of every conceivable background. Since the interviewers must answer many questions about the company and its policies, men with long and varied experience in the company are selected. Their experience is supplemented by special training.

The staff includes a supervisor and three clerks who prepare the routes and process the reports of the field workers.

Interviewing Techniques

This operation is not a survey in the ordinary sense. Interviewers ask only a few general questions to get conversation started. They listen while the customers talk. These initial questions have been carefully phrased and tested. They are successful in prompting comments about service, bills and other matters.

Asking a customer if his name appears correctly on the company's records is a pleasing and logical way to begin an interview. Offering him an opportunity to suggest improvements in service has led to such improvements. Giving him a chance to make complaints creates an opportunity to correct any causes of dissatisfaction.

Interviewers are prepared to answer questions about the company and the service; but they avoid argument. Much of the information customers desire is shown by some 70 recurring questions which they ask. The correct answers have been carefully prepared.

Through their contacts, the interviewers open new opportunities for the sales department to build load.

The interviewer writes his report of the interview after he leaves the customer's home. The report follows as nearly as possible the customer's own words. It is entirely objective. All reports are analyzed and summarized daily, as shown in the accompanying illustration. Comments are classified as "favorable," "adverse," "complaints," or "requests." Adverse comments are those that the interviewer explains to the customer's satisfaction. Reports of significant interviews are sent daily to all members of the company's executive staff. Reports that require immediate action are routed promptly to the various department heads concerned.

Monthly reports indicate the customer attitude toward the company by economic groups. Trends are noted by comparison with previous surveys in the corresponding economic tenth.

Special studies are also possible on a particular question of company policy. Such a check was made to determine whether the end of the war had caused a shift in customer attitude toward bi-monthly billing. It was found that although bi-monthly bills were well accepted during the war, they were less popular after the emergency need for conservation of manpower, transportation and materials had passed. As a result of this constructive criticism, monthly billing was resumed.

Six questions are used to keep the conversation rolling during interviews

1. **Does your name appear on your electric bills the way you want it to appear?**
2. **How have you found the company's service?**
3. **How have you found the company to do business with?**
4. **Do you get your bills regularly?**
5. **Have you noticed any of the company's advertisements in the newspapers?**
6. **How do you think we could improve service?**

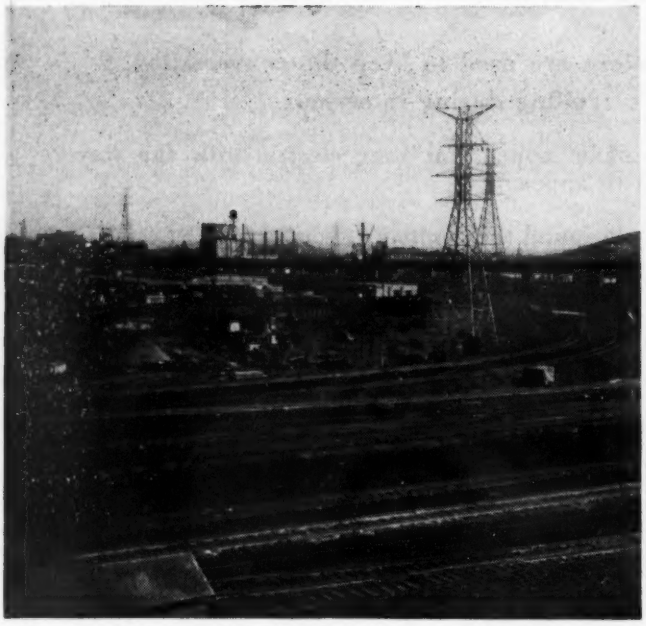
France Adding to Hydro Capacity

LARGEST hydro project in southern Europe, France's Genissiat development will have its first 65,000-kw unit in operation by the end of 1947. New 220-kv transmission circuits (ELECTRICAL WORLD, March 15, 1947, p. 97) will bring a good part of the first year's estimated half-billion kwhr northward as far as Paris.

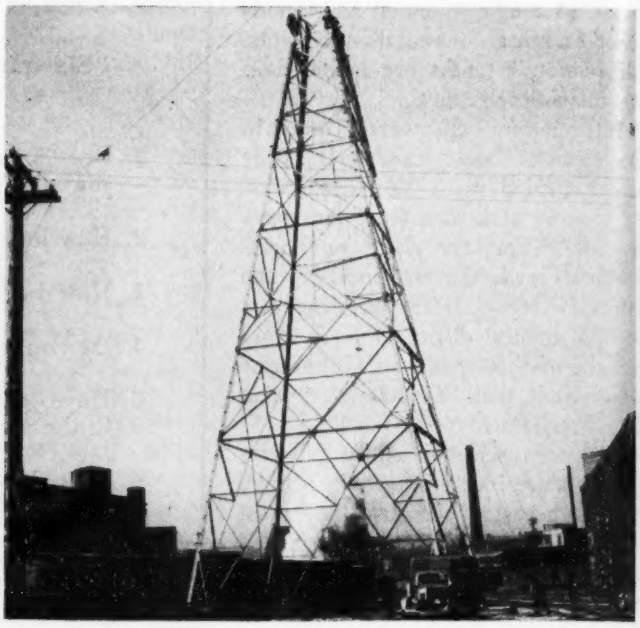
The six-year development of the upper Rhone should produce nearly two billion kwhr annually from Genissiat and a smaller dam for which scaffolding is now going up at Seyssel a few miles farther down river. In addition, American earth-moving equipment is now at work on a 16-mile canal-hydropower project between Mondragon and Donzere, straightening of the lower Rhone has been started and a small beginning has been made in draining the flats of the Rhone delta.

Genissiat dam proper, 340 ft high by 650 ft crest, will have six 19-ft penstocks leading to an initial installation of four 65,000-kw, 150-rpm Francis turbines under 225-ft head.

Genissiat Dam will cost approximately $60 million; the Donzere project another $140 million. Construction of additional canal-power projects is planned for the future.



ROUGH GOING —View showing some of the 77 tracks crossed in one section of seven spans. The line supplies power to flood-control pumps



CLOSE QUARTERS for towers and many obstructions for clearance made standard towers almost the exception. Location had to be reasonably close to the desired route

Right-of-Way Imposes Many Problems

W. R. WEISE
Supt Distribution Engineering
Cincinnati Gas & Electric Co
Cincinnati, Ohio

Transmission line serving flood prevention project has only 43 towers but 27 corners or dead-ends. . . Wire was strung under tension and special grounding was required

LOCATION of ground plots large enough for a tower and close enough to the route desired was the controlling factor in laying out a 66-kv transmission line to serve a flood prevention project in Cincinnati. Though only seven and one-half miles long, the completed line has 43 towers. Twenty-seven of these are corners or dead-ends. Seven railroads, the Union Passenger Terminal and yards, industrial plants, bridges, two double-deck viaducts, and a city park were in the right-of-way. These obstacles created unusual problems in design and construction. Reliability in operation, especially during floods, justified the best possible solution.

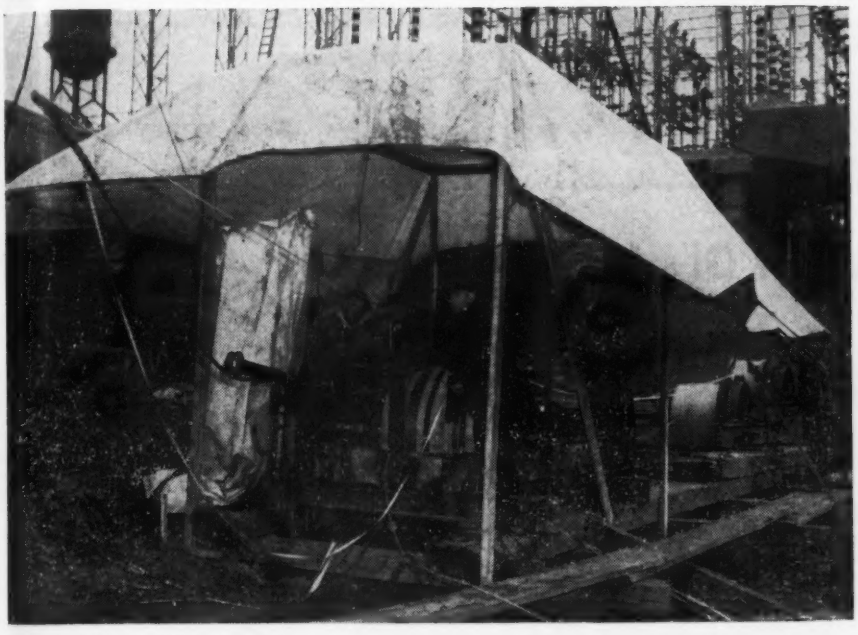
Two sources of power are made available to the pumping plant during flood periods. The power plant and one mile of the tower line for one service are surrounded by river water during floods. This condition, plus the nature of the soil and the many railroad tracks crossed, contributed to the decision to build overhead rather than with an underground cable.

When the Ohio River passes a flood stage of 52 ft, it backs up into Millcreek valley. This is the principal railroad and industrial area of Cincinnati. During the record flood of 1937, when the Ohio reached a stage of 80 ft, the waters extended nine miles up this side valley. The dam is designed to prevent this. When the Ohio reaches flood stage, gates will be lowered to stop the back waters. Water coming down the Millcreek valley must then be pumped from the 52-ft stage up to the Ohio River level. Six 6,500-hp motors are needed to pump the maximum flow and head.

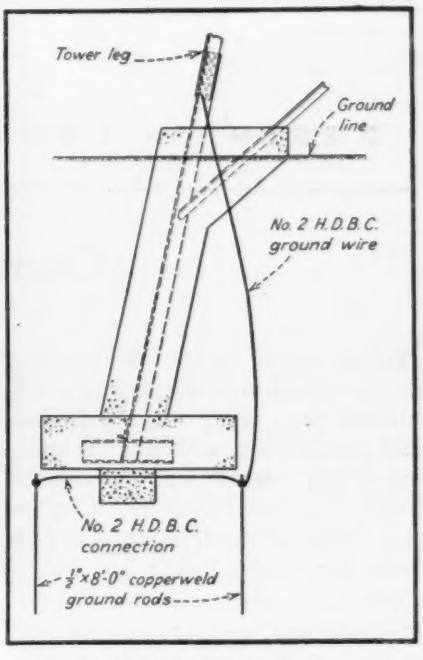
Two services to the dam interconnect the two major power sources of the electrical system. West End power plant, on the Ohio River about one mile from the dam, is floodproof to 87 ft. The second section of the line ties both to the Mitchell substation, which is connected to Columbia power plant 20 miles down the river, and to the major interconnections of the system with other utilities. This latter source has power available that is independent of flood conditions at Cincinnati.

Circuit Rating

The 66-kv circuit was designed for a nominal rating of 60,000 kw and an emergency rating of 80,000 kw. Tests on the suspension clamps with 400,000 cir mils HDBC showed that in the current range from 500 to 700 amp, a change from iron to Everdur U-bolts increased the allowable current-carrying capacity of the conductor by about 20 percent. With this change on all clamps, the emergency rating could be 700 amp without danger of excessively annealing the copper or causing other damage.



CONDUCTOR STRINGING under tension to maintain clearance between towers. Pay-out reel shown was controlled by brake action. The take-up reel was driven by an automobile engine through a slip clutch to maintain snubbing tension



AUXILIARY GROUNDING, in lieu of counterpoise, brought the average tower footing resistance down to 2.5 ohms. Ground resistance measurements were made before the backfilling operations on footing holes took place

in Seven-Mile Line

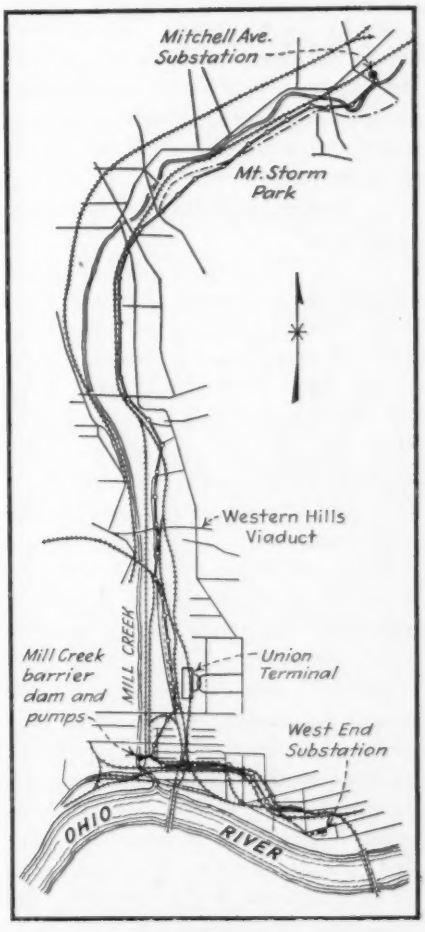
During floods, this line can help carry the West End plant load, including the downtown network, and the pumping load. During normal times, it will serve as a link in the interconnected power system. This is important, since leaving the line idle when it is not needed for flood pumping would greatly increase the investment charges for this service.

Wires Pulled Under Tension

Conductors of the one circuit are 400,000-cir mil copper. Provision is made for a second circuit later if needed. Towers are standard 109 or 113 ft with extensions up to 50 ft. Because of the many obstructions crossed by the line, conductors were pulled in under tension. This was done with a take-up power winch and pay-out control drum at the ends of line sections. Rope was pulled through the sheaves first. The rope, in turn, pulled a ⅜-in. steel cable to which the conductor was attached. A second steel cable was pulled with the first conductor. This cable was then in place to pull the second conductor and the static wire. During the stringing, a tension of about 2,000 lb was kept on the pay-off reel to provide adequate ground clearance between supports. Tension at the take-up rig ranged from 800 to 1,000 lb higher.

Protection level is designed for 16,-500 kv, with ten insulator disks in suspension and twelve at dead-ends. Ground wire clearance to conductor is 20 ft at towers and 30 ft mid-span. The ground resistance of all towers as installed was 2.5 ohms or less. Outage probability was calculated at once in twelve years on the 7-mile line.

Normal counterpoise or leg ground lines were not practical along most of the right-of-way. Another method of auxiliary grounding was necessary. Ground rods 8 ft long were driven from the bottoms of each of the 12-ft deep tower footing holes. A wire bus was installed to tie the rods together and to the tower legs. Ground resistance measurements were made before backfilling the footing holes. Four auxiliary rods, one at each leg, were sufficient in most cases. Additional rods were installed in some cases to bring resistance down to the desired value.



COMPLETE LAYOUT of the transmission line. Congestion of the route is apparent in this map which shows only the main railroad tracks that were crossed

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Courses Fit GI's for Utility Jobs

SOUND SLIDE FILMS, movies and similar visual aids are playing a significant part, along with theoretical and practical instruction, in the training of 110 veterans for jobs with the South Carolina Power Co, Charleston. Most of the training, which is being done under Public Law 346, is supervised-work experience. But several departments of the company have supplemented their schedules with visual aids and a library for trainees, which is also used by regular employees.

Sixteen apprentice courses—or "objectives"—all approved by the State Department of Education, are being given by the company. Six of these are in the electrical division, including: lineman, electrician, switchboard operator, appliance repairman, meter tester and serviceman. Non-apprenticeable courses are also given for relay testers and student electrical engineers.

Use of the educational films is coupled with general group discussion. Slide films used with explanations of functions of various mechanisms have been particularly helpful. Where practical, the sound slide films are followed by a physical disassembly of the unit, explanation of each part and its contribution to the functioning unit.

Worn or damaged parts are inserted in the mechanism to show how parts that need replacement interfere with operation. Attention is then drawn to losses that occur or to improper functioning of the unit. This method is particularly helpful to trainees in the appliance repair department. G. W. Moody, who is supervisor of the department, says that considerable time has been saved by this method of demonstrating the principles of refrigeration.

In the line department two training yards are being used, one at Charleston and the other at Walterboro.

FORMER GI GETS TRAINING in the operation of a "strobo" meter test board from meter foreman J. C. Lanier of South Carolina Power Co. The company has 110 veterans in training for 16 different types of jobs

Trainees are instructed by their foremen in basic duties of a lineman, using explanation, demonstration, and practice. Training manuals have been distributed to supervisors and the plan is to have specialized instructors follow a prescribed program. Trainees who have been assigned to regular line crews after "graduation" have shown themselves capable of performing regular work with a minimum of instruction and supervision.

Trainees within various departments have taken advantage of texts and other literature accumulated by the company. While their use is not compulsory as part of the course, the company encourages use of them as well as of research material and other information provided.

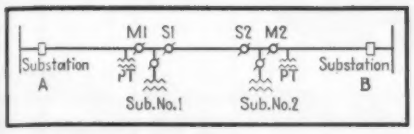
Of prime importance, the training programs are giving the employee a theoretical foundation of subjects taught, and at the same time the practical "know how" of operations. Confidence and efficiency have been gained, as well as experience.

•

Automatic Switching With Line Switches

J. B. HENDRICKS
Electrical Engineer
Wisconsin Gas & Electric Co
Racine, Wis.

SPRING-OPENED, manual-closed, air-break switches are combined with motor-operated air-break switches having complete automatic control in an arrangement developed by Wisconsin Gas & Electric Co. As shown in the accompanying diagram, the transmission line is supplied from both ends and switches are installed

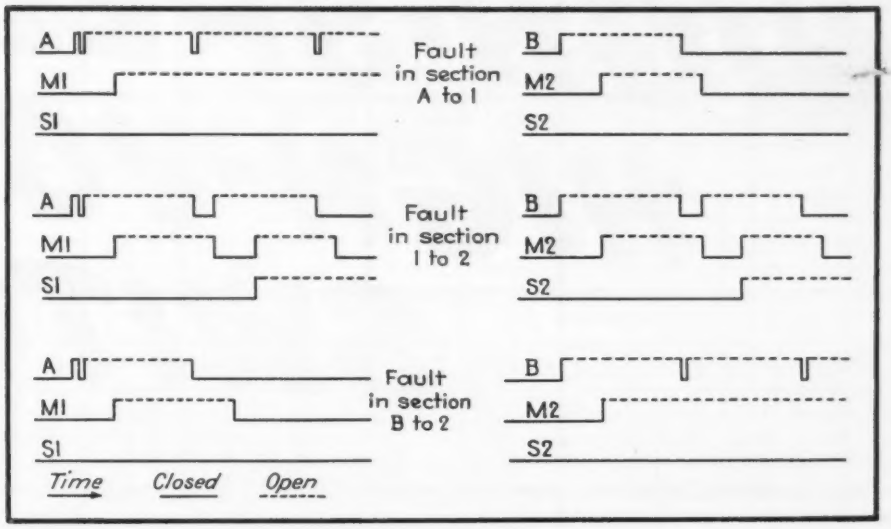


SPRING - OPENED switches, S, are controlled from the automatic motor-operated switches, M, in this line-sectionalizing scheme

on each side of the two substation taps.

No supply outage has occurred at either of the two substations since installation of this equipment to sectionalize 30 miles of 26-kv transmission line in 1940. Condition of the line had resulted in a rather poor record before the automatic control was installed. The switches have operated to sectionalize the line and isolate any fault, leaving two sections of line energized to supply the two substations.

Motor-operated switches, completely equipped for automatic control with voltage and sequence relays and time delay on both closing and tripping, are located on the supply substation side of each tap. The second air-break switch at each tap is opened by spring mechanism with tripping whenever the supply side air-break switch opens twice within a time interval set for two minutes.



SEQUENCE OF OPERATIONS of all switches is shown for the three possible fault locations. The spring-opened switches are tripped with second opening of the motor-operated switches, within a time interval

Operation for various fault conditions is illustrated in the sequence diagram. All air-break switches operate only when the line is deenergized. In this particular installation the substation at "B" is manually operated while "A" is an automatic substation.

Control of the spring-opened air-break switches is through a "b" contact in the control mechanism of the associated motor-operated switch. Upon the second opening of the motor-operated switch, as with a permanent fault between the taps, the spring trip circuit is energized and clears this section of line. These switches are then closed manually after a check of the line.

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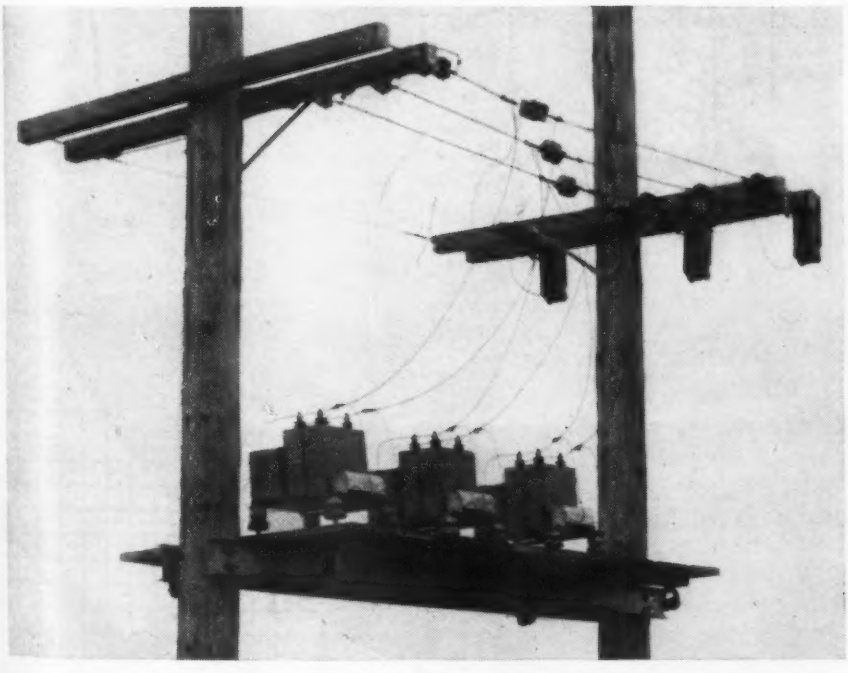
Series Capacitor Corrects Compressor-Motor Flicker

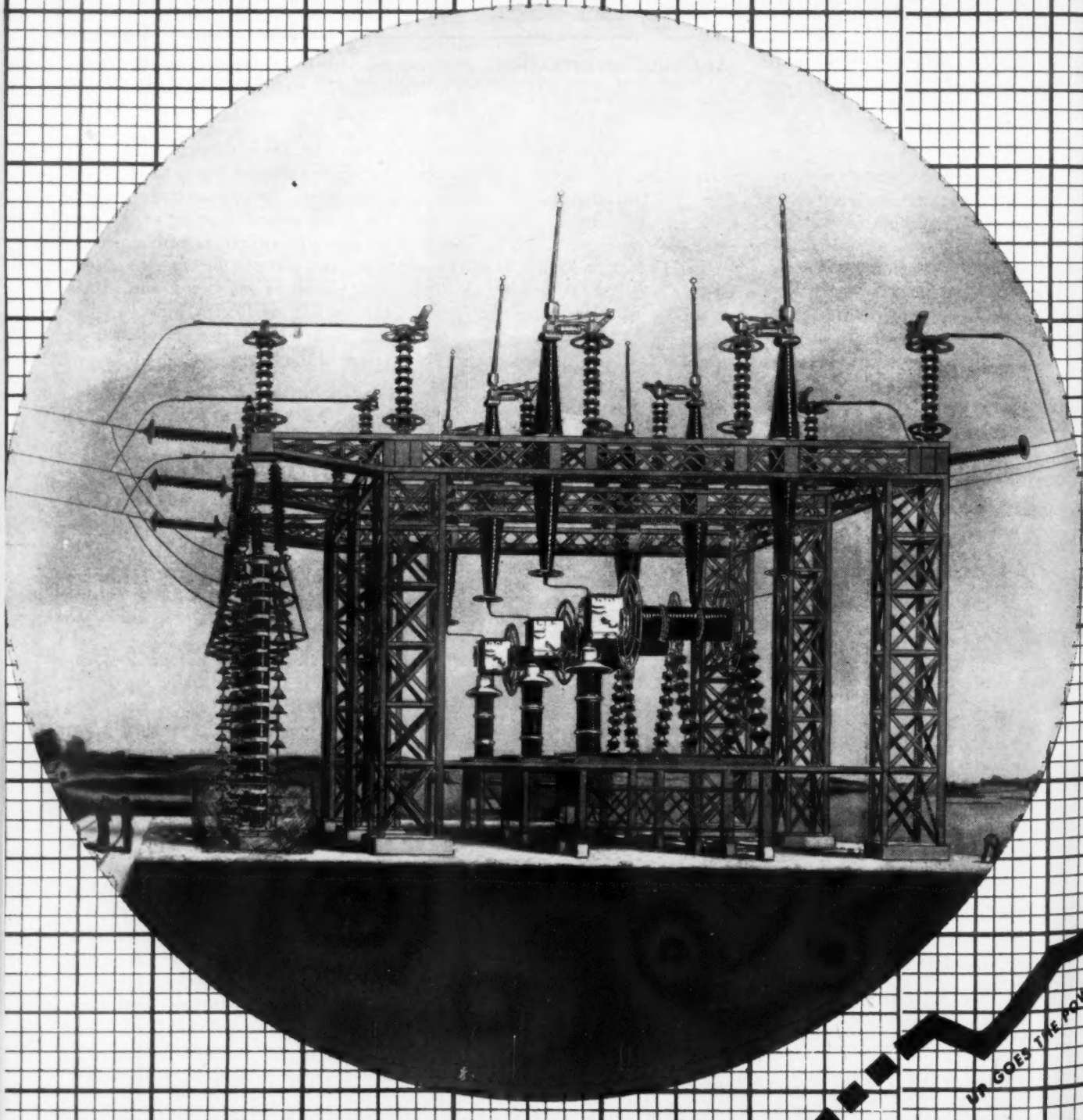
C. A. SCAMMON
Staff Engineer
West Penn Power Co
Pittsburgh, Pa.



SERIES CAPACITOR of 45 kva supports voltage when 60-hp compressor starts

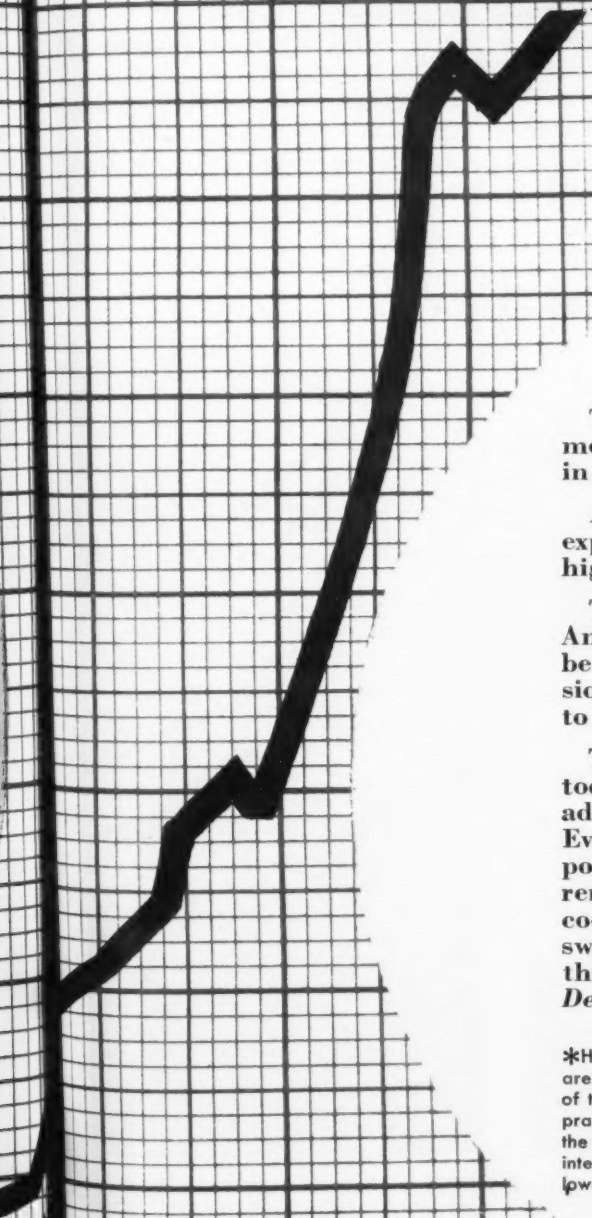
LAMP FLICKER on a long low-revenue rural line is usually the result of frequent starting of a comparatively large motor. A regulator on such a circuit is of little value because it cannot operate fast enough. In fact an induction regulator is likely to make matters worse by overtravelling. What is needed is a type of regulator that operates instantaneously and anticipates the voltage dips before they happen. In such cases a series capacitor *may* be the answer to the flicker problem. Whether it *is* the answer depends on a vector study directed at the resistance and reactance, including the load reactance because it may strongly influence the power factor in the line. If the power

HIGH-SPEED * HIGH-VOLTAGE SWITCHING



HIGH-VOLTAGE SWITCHING STATION FOR TIDD 500-KV TEST PROJECT.
(ARTIST'S CONCEPTION BASED ON ENGINEERING DRAWINGS.)

KEY TO HANDLING TOMORROW'S LOADS



The over-all functional equipment required to meet tomorrow's loads economically should be known in advance.

Assumptions, deductions, and time-consuming experience have established yesterday's and today's high-voltage level. This has been a costly method.

The "Tidd 500-kv Test Project," sponsored by the American Gas and Electric Service Corporation, will be an invaluable aid in exploring higher transmission voltages—in getting ready on a fact-finding basis to meet tomorrow's continually increased loads.

The high-voltage system of tomorrow, like that of today, will depend on switching equipment that can adequately control and protect the high-voltage lines. Every component of the switching station—including power circuit breakers, disconnecting switches, current transformers, and lightning arresters—must be co-ordinated to work as a unit. That is the way the switching station for the "Tidd Project"—shown at the left—was designed and constructed. ***Apparatus Dept., General Electric Company, Schenectady 5, N. Y.***

*High-speed "impulse" type circuit breakers, originated by General Electric, are used on the Tidd test project. These stored-energy type breakers are one of the most important steps ever taken to make ultra-high-voltage transmission practical, for they provide inherently high-speed, positive arc interruption over the entire range of currents. This means lower transient overvoltages, higher interrupting capacities, and greater stability limits—all of which add up to lower-cost high-voltage power transmission.

GENERAL ELECTRIC

factor in the line is very near unity, the voltage drop across the capacitor is practically at right angles to the voltage drop in the line and effects little or no boost. If the line current happens to be leading, the capacitor acts as a detriment just as a lagging current through a reactor inserted in the line causes a greater line drop than would be present without the reactor.

Thus a series capacitor has limitations as a voltage regulator. It will raise the line voltage only if the line current is lagging. At unity power factor it will do no good and if the power factor of the line is leading, it becomes a detriment.

In one case there was a 60-hp air compressor at the end of a three-phase line of three No. 4 conductors about 4½ miles long. A series capacitor installation consisting of two 7½-kva, 230-v capacitors per phase was installed near the center of the line. There was a small amount of lighting, perhaps 20 kw, near the end of the line and about the same near the beginning. The 11-v drop in the lighting voltage was brought down to about 3 near the end of the line. Of course the load near the beginning of the line was not affected. This installation was placed in service in 1940 and has been in service for almost seven years, except for some initial trouble, without subsequent trouble after it was corrected.

When the capacitive reactance voltage drop equals the inductive reactance drop it is possible to obtain a resonant condition. In this particular case there was such a condition. The load was a 60-hp wound rotor induction motor. As the motor came up to speed, the reactance component apparently decreased to a certain point where it just equaled the capacitive reactance, at some point below normal speed. The motor stuck at this sub-normal speed and both the line and motor rotor circuit drew an abnormal current which would ultimately trip the motor overload relays or below the transformer fuses.

The trouble was finally cleared by connecting a 25-ohm resistor, of about 10-amp capacity, at 230 v, across the terminals of each series capacitor unit. This completely cured the trouble; in fact it is believed that a 40-ohm resistor would have served the purpose just as well.

This is the only case of trouble of this kind we have ever encountered. Manufacturers advise that it can only happen on a wound-rotor motor, that a squirrel-cage motor will never cause trouble.

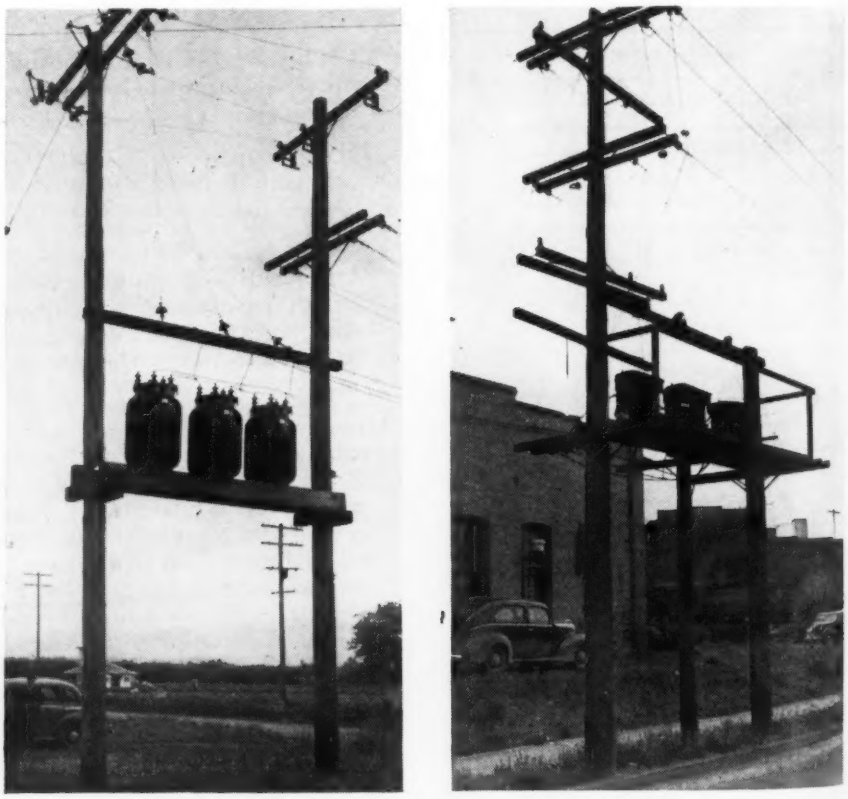
• • •

Improved Transformer Rack

GEORGE BRUNZELL
Washington Water Power Co
Spokane, Wash.

OUT OF THE YEARS of building transformer racks, there has been evolved by the Washington Water Power Co the simplified structure shown. It consists simply of two poles, usually one long and one short, between which are placed two 6x12-in. by 14-ft plank timbers. No platform and railing are built around the transformers and no short boards are used on which to set the transformers. The bottoms of the transformers simply rest on the two timbers, which are ample.

Fuses are placed on the primary line arm of the tall pole and transformer leads make a quarter turn to a single arm above the transformers. Structures of this kind are used for transformers up to three 100's. Larger than that, a pole stub is placed under the center of the timbers for greater support. The old idea of having to place fuses where they could be reached from a railed platform, as shown by the illustration of an older installation, has been found from experience to have no logic nor advantage and only complicates and increases the cost of transformer structures. Nor is there any good reason to place cross boards beneath the transformers. After the transformers are once installed, there is no occasion to be around them unless they have to be replaced. A complicated, costly and unsightly structure is unjustified when a simpler one as described meets the triple requirements of strength, safety and workmanship.



TRANSFORMER BANK supported on double timber beam between two poles is cheaper, cleaner design than 3-pole rack at right

Transmission Line Design Simplified by Graphical Aids . . . I*

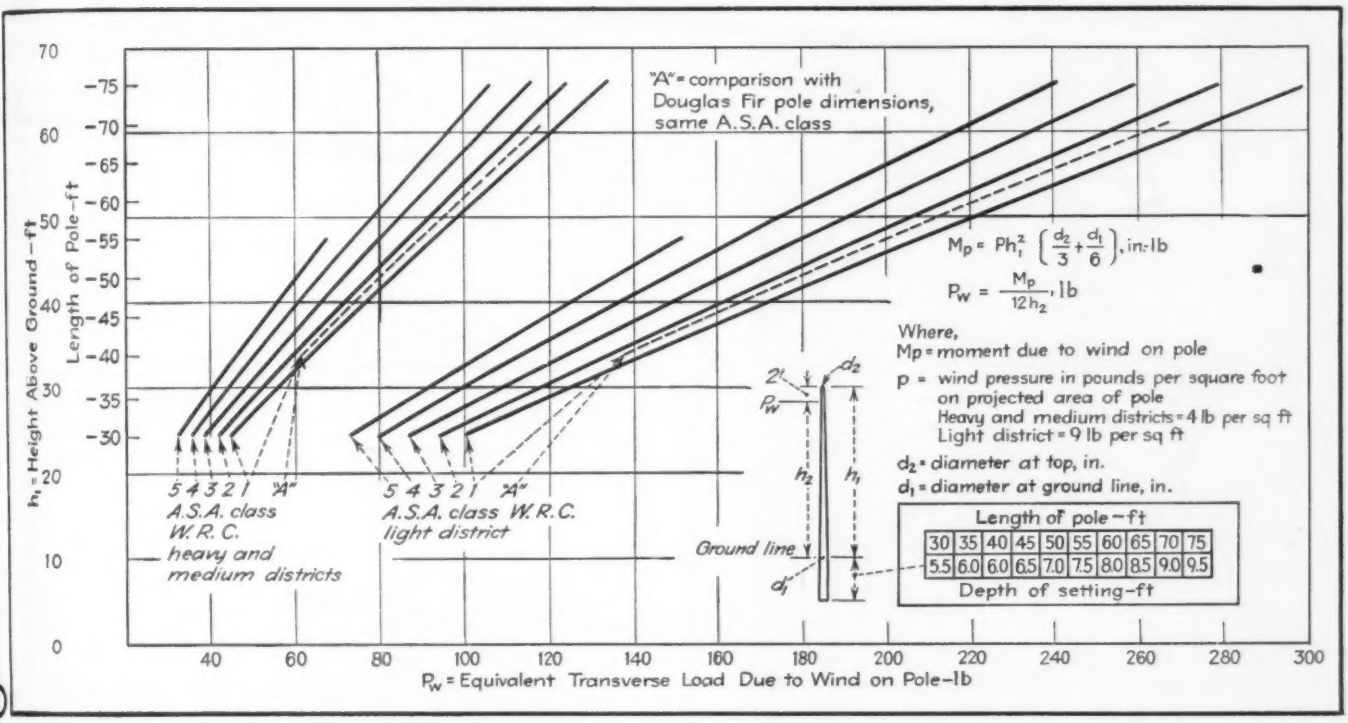

"A" = comparison with Douglas Fir pole dimensions, same A.S.A. class
$M_p = Ph_1^2\left(\frac{d_2}{3}+\frac{d_1}{6}\right)$, in-lb
$P_w = \frac{M_p}{12h_2}$, lb
Where,
Mp = moment due to wind on pole
p = wind pressure in pounds per square foot on projected area of pole
Heavy and medium districts = 4 lb per sq ft
Light district = 9 lb per sq ft
d_2 = diameter at top, in.
d_1 = diameter at ground line, in.
Length of pole – ft
30 35 40 45 50 55 60 65 70 75
5.5 6.0 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5
Depth of setting – ft
5 4 3 2 1 "A" A.S.A. class W.R.C. heavy and medium districts
5 4 3 2 1 "A" A.S.A. class W.R.C. light district
Ground line
h_1 = Height Above Ground – ft
Length of Pole – ft
P_w = Equivalent Transverse Load Due to Wind on Pole – lb

CHART 1 shows equivalent transverse load due to wind on pole

HAROLD V. WINGFIELD†
Engineer
Sverdrup and Parcel, Consulting Engineers
San Francisco, Calif.

Method involves use of three charts and permits comprehensive study of alternate designs. First chart which is explained here has been developed to give the equivalent wind load on poles. Horizontal separating of conductors and relationship between pole height and span length are obtainable from two other charts which will appear in subsequent issues

Among the most important factors affecting this type of design work are:

1. Loading district
2. Conductor size and material
3. Grade and type of construction of the line
4. Terrain, ground and increased clearances
5. Pole class and length
6. Mechanical stability

ALL THE FACTORS are considered in the charts. References used in the chart compilation were American Standards Association Specifications 05.2 (1941) and 05.6 (1941) for pole classes and dimensions, the National Bureau of Standards Handbook H32 comprising Part 2 of the National Electric Safety Code, and applicable sag charts published by the industry.

The pole is considered a cantilever beam fixed in the earth at the butt and is required to support itself plus the transverse wind load on it and on the conductors when covered with ice. Transverse wind load on the insulators, crossarm and brace has not been considered.

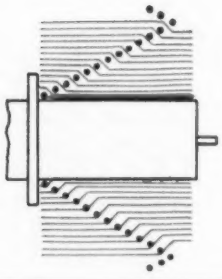
Chart I consists of a family of curves indicating the equivalent transverse load, 2 ft from the top of the pole, due to wind on the projected area of the pole. Applicable ASA specifications for Western Red Cedar Class and dimensions were used because these specified dimensions are larger than those of other species of poles. NESC rules as to requirements for various loading districts were used, along with accepted methods, to compile the data illustrated.

A comparison was made in the computations, using Douglas Fir pole specified dimensions for the same ASA class, and this is indicated on the chart. It may be noted that there is slightly less equivalent transverse load on this species of pole. This is accounted for by the smaller top and ground line diameters. However, the curves for the WRC species may be used, giving the designer a slight additional factor of safety.

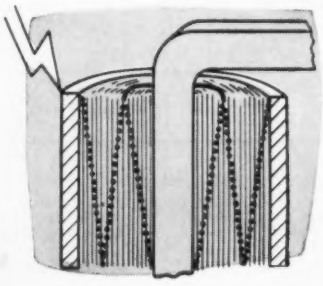
Values of P_w obtained from Chart 1 will be used in the third installment of this three-part series.

* Beginning a series of three reference sheets.
† Formerly electrical engineer, U. S. Department of Interior, Office of Indian Affairs, Los Angeles, Calif.

GENERAL ELECTRIC REPORTS ON UNIQUE WINDING METHOD THAT BOOST



Cross section showing how progressive-layer winding proportions insulation strength to voltage stress.



Electrostatic shield distributes surges over entire winding, prevents destructive concentrations.

AND SHIELDING

IMPULSE STRENGTH TO NEW HIGH

● All G-E Spirakore distribution transformers, rated 22,000 volts and above, have progressive-layer insulation and shielding.

There are now more than 2700 high-voltage Spirakore distribution transformers in service which have shielded windings and progressive-layer insulation. Some have seen more than *five lightning seasons. Their operating record to date is practically perfect.*

PROGRESSIVE-LAYER INSULATION

In developing progressive-layer insulation, General Electric has adapted a basic mechanical principle to electrical design. It is the principle of applying the greatest strength where greatest stresses exist. By a unique method of construction, General Electric has greatly increased the impulse strength of transformer insulation.

How it is done

In a multi-layer coil, the voltage stress—normal and impulse—between layers ranges from that between adjacent turns at one end of the layer to many times this stress at the other.

With progressive layer insulation, this difference in stresses is compensated for by winding into the coil, along with the conductor, a full-width layer of thin, tough paper of high dielectric strength. As turns are added, the paper layers increase in number. In this way, the insulation strength between any two conductors is kept proportional to the voltage stress, regardless of the position of the conductors in the winding—an important contribution to the superior impulse strength of G-E high-voltage transformers.

SHIELDING

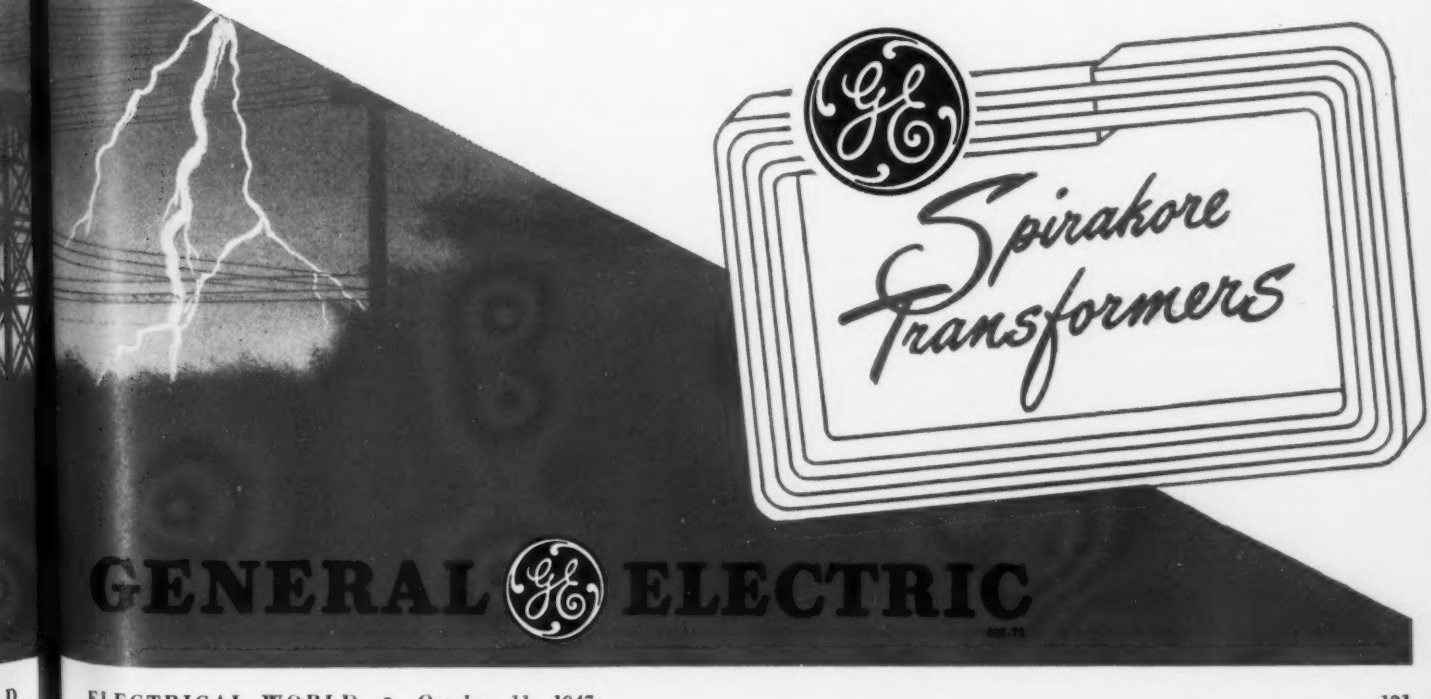
Electrostatic shielding, a development of General Electric, was introduced first in the power-transformer field in 1926. Since then, thousands of shielded-winding power transformers, totaling more than 25,000,000 kva have been built. Their service records have clearly demonstrated the value of shielding as the best means of preventing harmful concentrations of voltage caused by transient voltage surges.

How it works

Electrostatic shielding is the electrical equivalent of protecting a brittle mechanical structure by encasing it in a steel shell. The force of a shock or sudden blow, which would be destructive if concentrated at one point, is distributed over a large area so that stresses can be absorbed without damage.

In General Electric high-voltage distribution transformers, an insulated metal shield is placed around the windings and is electrically connected to the line end of the winding. The surge voltage allowed by the lightning arrester, which might otherwise produce tens of thousands of volts between adjacent layers or turns, is so distributed by the shield as to prevent harmful concentrations of voltage stresses.

ASK FOR THIS BULLETIN *General Electric's new bulletin, GEA-4521, on shielded windings and progressive-layer insulation, is now being distributed. If you have not received a copy, write Apparatus Department, General Electric Company, Schenectady 5, N. Y.*



How To Ground, Bond and Insulate Cables, Potheads and Joints

A procedure for generating station and substation installations; an adaptation from approved methods of Philadelphia Electric Co

1.0 General Instructions

1.1 The term "ground" is used herein to designate a connection to the network of uninsulated, buried conductors at substations or generating stations. The term "bond" is used to designate a connection across joints to make the conducting coverings of cables continuous, or connections between the conducting coverings of two or more cables.

1.2 One-inch zinc strapping and galvanized or other corrosion resisting bolts shall be used for bonding or grounding braids and metal shielding taps.

1.3 Lead-covered cable shall be bonded or grounded with conductors adequate to carry the calculated short-circuit currents for the required time.

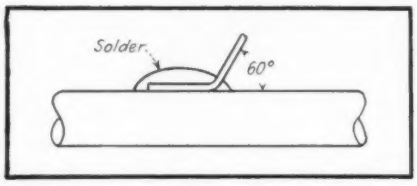
1.4 No more than one cable shall be grounded by a single strap. Straps shall be bolted around the cable and to the ground bus. Straps shall not be used in wet locations. Soldered wire bonds of suitable size shall be used. To prevent corrosion the wire shall leave the sheath at a minimum angle of 60 deg as shown in the sketch. No wire shall touch the sheath except where it is soldered.

2.0 600-V Cable

2.1 Only metallic coverings shall be grounded.

2.2 Lead-covered cables in non-metallic conduit shall be bonded in each manhole and pull box. Cables more than 50 ft long shall have at least two grounds, one near each end. Cables 50 ft or less in length require only one ground, provided it is in a location where it is not likely to be broken or corroded off. Grounds and bonds may be omitted from lead-covered cable in grounded metallic conduit system. Where a taped joint is inserted in lead-covered cable, the lead sheaths shall be bonded together across the joint. Where a cable with non-metallic covering is inserted in series with a lead-covered cable, the discontinuity of the sheath must be corrected by bonding to lead-covered cables or other metallic structures which pass through the discontinuity or by grounding. Single-conductor cables carrying alternating current and installed one per duct shall have but one ground on each run. The ground may be placed at the most convenient point. If conduit is metallic, the remainder of the conduit as well as the sheath must have no other metallic connections to ground.

2.3 Metallic armor of buried cable shall be bonded together in each manhole and pull box in which joints are made in the cable. Cables more than 50 ft long shall have at least two grounds, one near each end. Cables 50 ft or less in length require only one ground, provided it is in a location where it is not likely to be broken or corroded off. Bonds and grounds are attached by removing the coverings, thus exposing the armor, soldering the bond to it, and replacing the coverings with friction tape coated with asphalt paint.



BOND attached to lead sheath

2.4 BX armor is sufficiently grounded by the metallic contact of the fittings.

2.5 Metal tape of multiconductor control cable shall be grounded and its continuity maintained by bonding across joints. Grounded building steel or apparatus frames furnish satisfactory ground points. Cables more than 50 ft long shall have at least two grounds, one near each end. Cables 50 ft or less in length require only one ground, provided it is in a location where it is not likely to be broken or corroded off. The metal tape is grounded at the end by zinc strapping bolted around the cable over the metal tape. If more convenient, bonds may be attached at other points than the ends by carefully removing a section of braid, thus exposing the metal tape for the distance required to make the connection. Clean the tape carefully with a rag moistened with cleaning fluid. The connection is made by bolting zinc strapping around the cable over the metal tape. If the ground attachment point is to operate buried, wrap a turn or two of wire around the cable over the tape and tighten by twisting the ends together. Tack-solder the wire to the metal tape using a soldering iron. If more convenient, this method may be used under other conditions. *Do not use a torch as excessive heat will damage the cable.*

3.0 2.4/5-Kv Cable

3.1 All gray or white semi-conducting asbestos braids of rubber insulated cable in non-metallic conduit shall be grounded at the terminals and in splicing chambers. Grounds are unnecessary on cable in grounded metallic conduit. Cable in conduit 25 ft or less in length requires only one ground provided it is in a location where it is not likely to be broken or corroded off. Cable not in conduit should be supported by metal fastenings attached to the building steel. The braid of cable run on porcelain cleats, alberene stone, or wood blocks shall be grounded. On long cables, these grounds shall be placed every 25 ft. Connection to the building steel is a satisfactory ground for this service. These braids shall be bonded across cable joints.

3.2 Black non-conducting cotton braids on rubber-insulated cable and varnished cambric cable shall not be grounded.

3.3 Lead sheath shall *always* be bonded and grounded. This shall be done as described in Par. 2.2.

4.0 13-2-Kv Cable

4.1 Conducting braid shall be bonded and grounded as described in Par. 3.1.

4.2 Braid of varnished cambric cable shall not be bonded or grounded.

4.3 Copper shielding tape on the outside of the insulation of varnished cambric insulated cables shall be grounded at each terminal and shall be bonded and grounded in each splicing chamber.

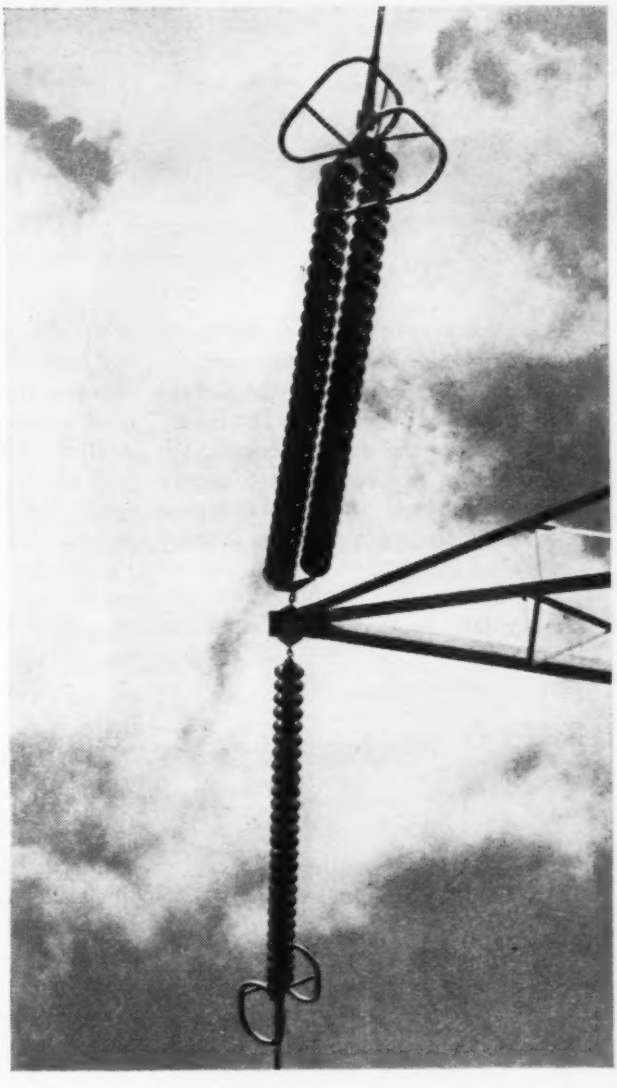
4.4 Lead sheath of 3-conductor cable shall be grounded at the pot-head in the station and bonded in each manhole. Ground the pothead with ⅛-in. x 1-in. copper bolted directly to the pothead by means of mounting bolts or bolted to the steel pothead support. Ground connection shall be made at the pothead except where current transformers are installed over the cable sheath. In this case the pothead shall be insulated from ground and ground connection attached to the cable sheath on the line side of the current transformer.

4.5 Lead sheaths of three single-conductor cables installed in one duct shall be grounded and bonded as described in Par. 4.4 for 3-conductor cable.

4.6 Lead sheath of single-conductor cable installed one per duct shall be grounded at the terminals in the station and insulated at the outdoor terminals. If both terminals are indoors or outdoors, the terminal at the bus shall be grounded and the terminal at the equipment shall be insulated. If the cable-joint sleeves contain insulators, special instructions for grounding and insulating will be issued.

world's BIGGEST PROBLEM!

WITH almost the same ease and matter-of-factness as snapping on a light in the living room, a switch was closed at Brilliant, Ohio, October 1, which energized a power line at the highest voltage yet attempted in the transmission of electrical energy. To be operated experimentally by the American Gas & Electric Company, this line will be used to investigate the problems that arise in the range of transmission voltages up to 500 kv. From this proving ground of ideas and equipment is expected to come practical knowledge that will advance the art of high-voltage transmission many steps beyond its present frontier. O-B has been privileged to supply the station insulation and a portion of the line insulation for this prominent project.



2752-H

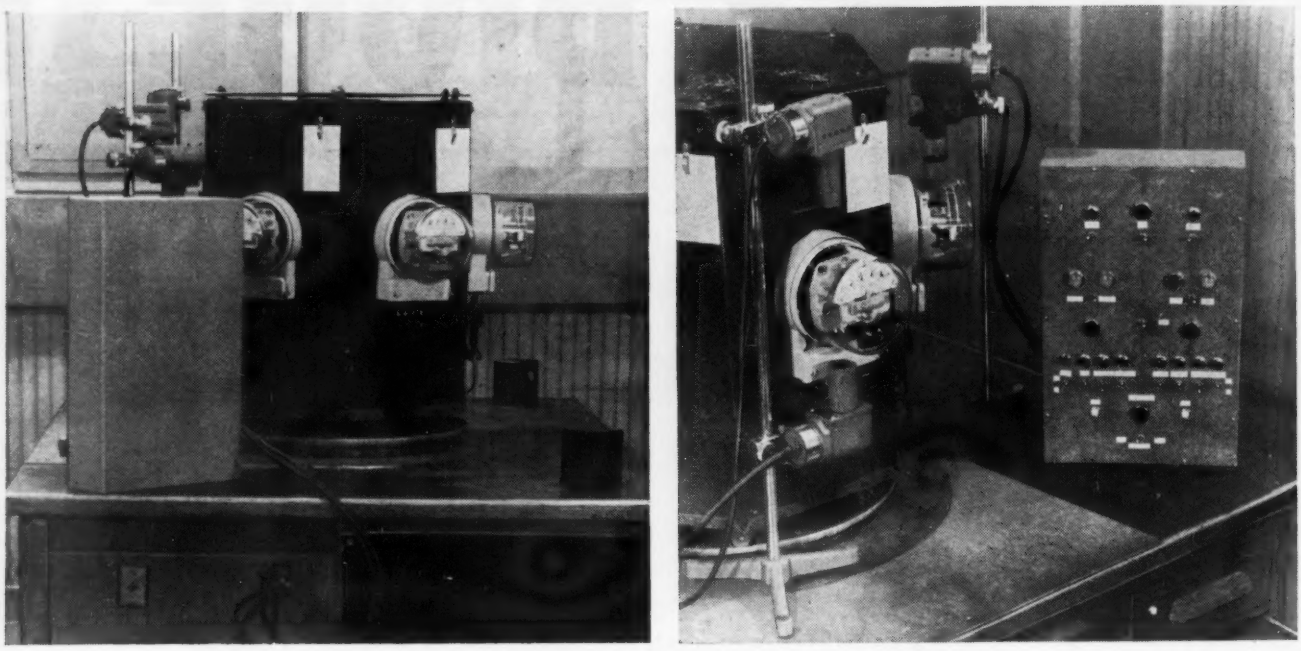
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Company, Limited
Niagara Falls, . . . Ontario

HEADQUARTERS FOR PORCELAIN INSULATION

Test Meters Faster with Rotating Rack



TURRET-TOP TEST RACK for single-phase meters. An assistant mounts the meters for the tester, and a photoelectric eye counts them

ASSEMBLY LINE METHODS in meter testing are introduced with a new design turret-top test rack of the Kansas City Power and Light Co. The rotary rack enables the average tester with an assistant to check approximately 200 single-phase watthour meters a day, compared to a previous average of 26 per man.

Semi-automatic in operation, the rack rotates so that the assistant can keep a continuous stream of meters in position for the tester, who then devotes his entire time to checking and adjustments. Test loads and potential voltage to the meter under test are relay controlled, operated by small toggle switches on the control panel.

The revolution count is made on each load by use of a photoelectric counter. On completion of the accuracy test, the pushbutton transfer relay switches the meter to the high-potential insulation test circuit. High potential is applied by two pushbuttons which do not permit the tester to get his hands or tools in contact with the potential applied.

This new arrangement was designed by L. W. Jones, Owen Hetzler and C. A. Sloan and built in the company laboratory.

• • •

Use of Damper Windings on A-C Generators

IV*—STABILITY AND VOLTAGE REGULATION

WILLIAM L. RINGLAND
Electrical Engineer
Allis-Chalmers Mfg Co
Milwaukee, Wis.

THE ABILITY of a generator to maintain voltage or to resist loss of synchronism is improved only a negligible amount in most instances by a damper winding. Although the subtransient currents in the damper winding do act beneficially to maintain the generator flux, the time constant for their decay is of the order of a few cycles, which represents a very rapid decay compared to the field and mechanical transients. However, for loads demanding intermittent power impulses of a duration comparable to this time constant, such as seam and spot welders, the action of the damper winding in reducing the voltage variation can be appreciable and valuable.

A damper winding will, to some extent, assist a waterwheel generator to remain in step following an unbalanced short-circuit. Although the current delivered during the fault may be several times normal, the pull-out torque of the generator may be low because of the low terminal voltage. However, the waterwheel torque cannot be rapidly reduced because of the time required to close the gate, resulting in an excess of torque and acceleration of the unit. The negative-sequence component of the unbalanced short-circuit current produces a loss in the damper winding proportional to the negative-sequence resistance. This power loss serves to a degree as a brake on the unit and extends the length of time that the unit will remain in synchronism. Unfortunately, a relatively high-resistance damper winding is required to give the maximum effect in this respect while a low resistance is preferable for most of the other functions

* This series began in ELECTRICAL WORLD, August 16, 1947, page 81.

C-D Micabond . . .

gives you . . .

high heat resistance

high moisture resistance

high dielectric strength

If you want electrical insulation that will withstand heat—that is little affected by moisture—and that will provide excellent dielectric properties—specify C-D Micabond.

Micabond combines the heat resistance, moisture resistance and electrical insulating properties of raw mica into easy-to-use sheet, tube and tape form. Micabond sheet is easily punched and formed for commutator segments and rings, heating element insulators, terminal washers and similar applications. Micabond tube is ideal for many applications such as resistance coils and insulating bushings. Micabond tape is used extensively as a highly efficient insulating wrapping for coils.

C-D Micabond is made in 23 standard types and grades —one or more of which is sure to give you the specific insulating properties required to improve the overall performance of your product. For complete information on C-D Micabond, write for our latest Micabond bulletin or ask us to have an engineer help you with your problem.

C-D NON-METALLIC PRODUCTS

DIAMOND VULCANIZED FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

DILECTO—Thermosetting Laminated Plastics.

CELORON—A Molded Phenolic Plastic.

MICABOND—Built-up Mica Electrical Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

STANDARD & SPECIAL FORMS

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

DESCRIPTIVE LITERATURE

Bulletin GF gives Comprehensive Data on all C-D Products. Catalogs are also available.

Continental-Diamond C-D Engineered Non-Metallics

D-5

BRANCH OFFICES: NEW YORK 17 • CLEVELAND 14 • CHICAGO 11 • SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES
WEST COAST REPRESENTATIVES: MARWOOD LTD., SAN FRANCISCO 3 • IN CANADA: DIAMOND STATE FIBRE CO., OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK 15 DELAWARE

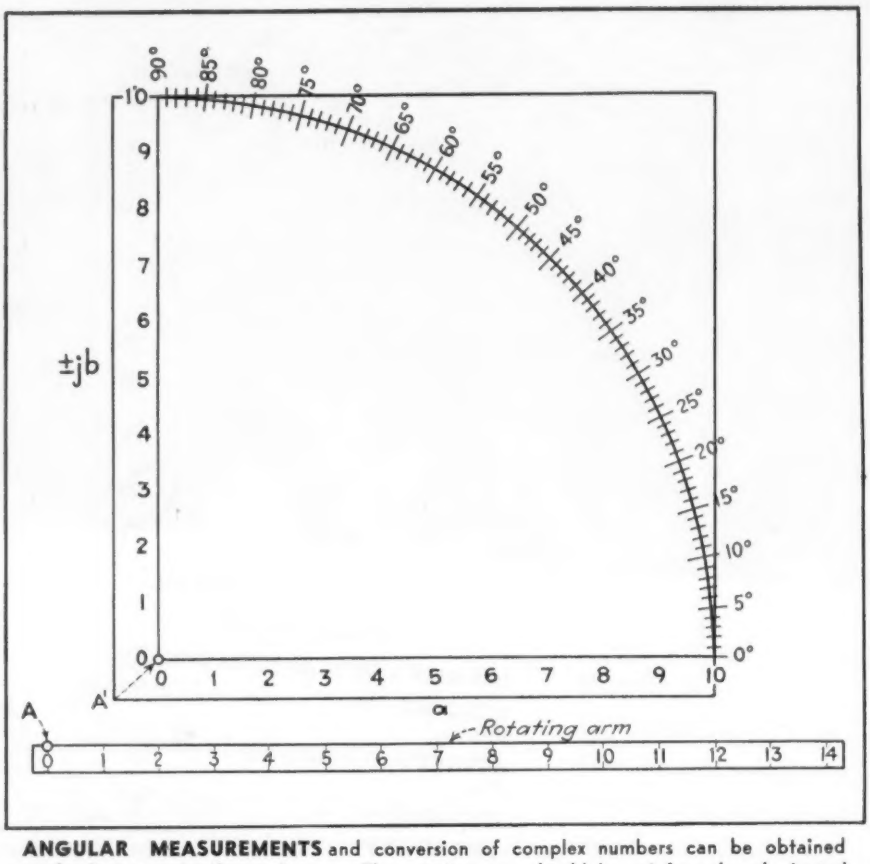
of a generator damper winding.

Sustained unbalanced loads cause unbalanced voltages, the magnitude of the voltage unbalance being proportional to the generator negative-sequence reactance. A damper winding reduces reactance to about 60 percent of its value without dampers, and improves the voltage unbalance.

• • •

Simple Quadrant Speeds Complex Number Conversion

LEONARD BRUH
Passaic, N. J.



ANGULAR MEASUREMENTS and conversion of complex numbers can be obtained to the first two significant figures. The rotating arm should be reinforced and pivoted at points A and A'

CONVERSION of complex numbers is easy with the simple quadrant chart shown: The following conversion illustrates its use.

Example: Conversion of rectangular to polar coordinate. Let the quantity (a + jb) represent (6.3 + j 7.2). Proceed vertically from 6.3 on the abscissa (marked "a") and proceed horizontally from 7.2 on the ordinate ("marked ± jb"). Move the arm up to the point of intersection. Magnitude of the polar form is read directly from the scale on the rotating arm. Angular measurement is read at the same time, by noting where the arm crosses the angular indications. Thus by one simple operation Z $\angle\theta$ has been found; result 9.5 $\angle$49°.

To find the rectangular form from the polar, the inverse operation is performed.

From the magnitude of the polar form on the arm, proceed horizontally to the ordinate and vertically to the abscissa, and read the rectangular coordinates of the polar form.

• • •

Pole Lengths for Minimum Line Clearances

A CONVENIENT TABULATION of minimum pole heights above ground to insure required clearances in rural line construction on the New England Electric System is given below. Poles are selected to provide the necessary clearances above ground, and, in the case of jointly owned poles, the required separation between power wires and telephone wires and cables, at the pole.

Minimum clearances above ground in rural districts are:

1. For power wires, 18 ft up to 175-ft spans, plus 0.1 ft per 10-ft span increase.

2. For telephone wires, 14 ft up to 175-ft spans, plus 0.1 ft per 10-ft span increase.

Minimum vertical separation at pole for various types of lines is:

1. Between power wire (750-8,700 v) and telephone cable or wire: The power wire final sag at 60 deg F no wind plus 30 in., minus 40 in.

2. Between power wire (0-750 v) and telephone cable or wire: The power wire final sag at 60 deg F, no

Relation between level ground span length and minimum pole height above ground to provide the clearances and separations specified here. Minimum vertical separation at the pole, between power and telephone conductors is shown for those span lengths which may be jointly used.

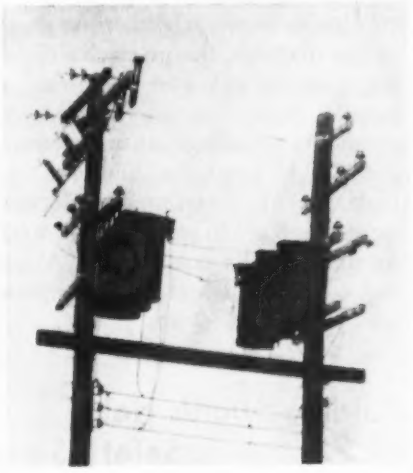
	Minimum Pole Height (Feet) Above Ground Level Ground Spans				Minimum Vertical Separation Between Power and Telephone Wires at Pole (Inches)	
	Amerductor #6		Copperweld 6A			
Span (Feet)	Over Rural Areas	Crossing Street	Over Rural Areas	Crossing Street	Amerductor #6	Copperweld 6A
200	20	23	20	23	40	40
250	21	24	21	24	44	44
300	22	26	23	27	56	58
350	25	29	25	29	70	78
400	28	32	30	34	89	114
450	29	31	32	34	..	..
500	33	35	36	38	..	..
550	37	39	41	43	..	..
600	41	43	47	49	..	..

wind, minimum 40-in separation.

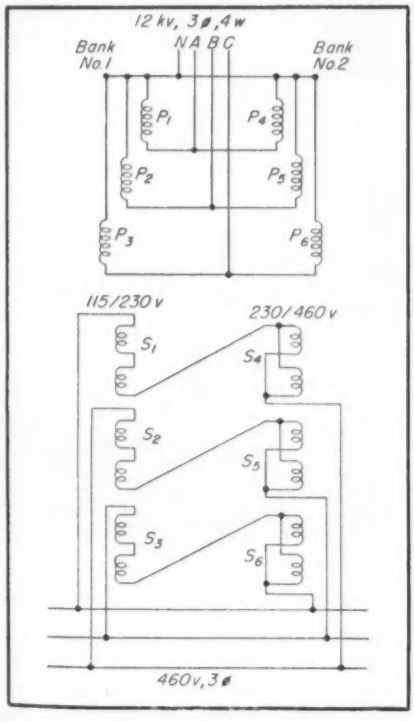
3. Between transformer case and telephone cable or wire: 40 in.

•

12,000/460-Volt Service By Unusual Connections



POLE ARRANGEMENT used for mounting six 25-kva transformers. Each set of three is mounted on a single pole, and the two banks placed to face each other



TWO TRANSFORMER BANKS have 6,900-v primaries connected to 12-kv, 4-wire circuit and supply 3-phase, 460-v load

UNCOMMONLY USED secondary connections were required in mounting six transformers on the Hernando line of the Mississippi Power and Light Co to supply a 150-hp load

PACKAGED POWER

ALWAYS READY . . .

THE *Albertson*

UNIVERSAL REPLACEMENT

CORES and COILS

Fit any type

TRANSFORMER CASE

SQUARE • ROUND

OVAL • HEXAGON

RECTANGULAR

Sizes: 3 TO 25 KVA INC.

•

★ Albertson "UNIVERSAL" Replacement Cores and Coils save time and costs. Quick replacement is much more important than actual dollar repair cost. With this NEW Albertson service, replacements can be stocked in their special moisture-proof containers which protect them for indefinite periods. Replacements are ready at a moment's notice. This is the modern way to solve what has been an expensive problem. Get those burnt-out Transformers back in service quickly and economically the Albertson way. Low losses permit the use of 3 KVA and 5 KVA Packaged Power Replacement Core and Coils in 1 and 1½ KVA Transformer Tanks.

Built in accordanc with AIEE and NEM standards

CHECK THESE FEATURES

1. FIT ANY TYPE OF CASE
2. SHIPPED IN MOISTURE-PROOF CONTAINERS
3. CAN BE STORED IN STOCKROOM FOR EMERGENCIES
4. LOWEST COST — NO FREIGHT CHARGES TO PAY ON REPAIR JOBS
5. REPLACEMENT CORES ALWAYS AVAILABLE
6. EASY TO INSTALL
7. NO DELAY ON REPAIRS — INSTALL ON JOB IF NECESSARY
8. MINIMUM CORE AND COPPER LOSSES GIVE MAXIMUM OVERALL EFFICIENCY
9. INCREASE YOUR 1 AND 1½ KVA TRANSFORMERS TO 3 AND 5 KVA CAPACITY THIS SIMPLE, QUICK, COST-SAVING WAY. EFFICIENT DESIGN ASSURES LONG LIFE.
10. GUARANTEED FOR ONE YEAR

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Since 1910

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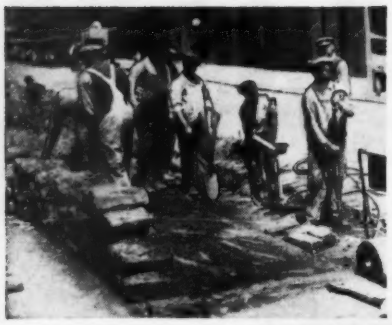

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Four of many uses of Schramm Air Compressors in the Utility field. No matter how tough the job, or where it is, the versatile Schramm is a hard-hitter that furnishes air easily, quickly, economically.

Schramm features. (1) Watercooling 100% (2) Forced Feed Lubrication (3) Mechanical Intake Valve (4) Compact lightweight units, easily moved about.

Today Utilities throughout the country are using Schramm Air Compressors. There's a wide range of Schramms to select from, ranging from 20 to 420 cu. ft. actual air. We invite you to write us today for complete details on our many models.

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with 460-v service from a 12-kv, 3-phase, 4-wire line. The only transformers available were three rated at 25 kva, 6,900-115/230 v, single phase, and three rated at 25 kva, 6,900-230/460 v, single phase.

According to W. B. Profilet, division superintendent, each set of three transformers was mounted on a separate pole and was placed so that the two banks faced each other. As shown in the diagram, the primaries of facing transformers were connected in parallel from line to neutral. All secondary windings were connected for 230-v operation and the secondaries of opposite transformers were connected in series to give 460 v, forming a delta connection. A neutral conductor is not run through on secondary service.

•

Folding Stands Hold Safety Signs

SAFETY SIGNS are kept upright by means of folding stands (top). Center legs are turned and aligned with outside legs (below) so signs can be stacked

So THAT safety signs will stand upright where they are needed, C. W. Holden, boiler room foreman of the Central Power and Light Co's La Palma Power Station at San Benito, had folding stands made as shown in the illustration. Material for each

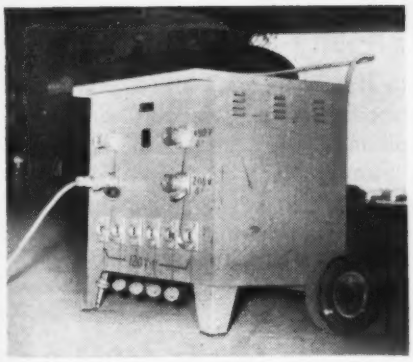
stand includes 26 in. of 1-in. angle iron, 4 ft of ½-in. pipe, one rivet and three small stove bolts. Labor is estimated at three stands per hour. The legs, approximately 12 in. long, are welded to the angle iron cross pieces.

The idea was advanced in connection with a new addition at the La Palma plant, when considerable work was going on overhead while operators had to continue their duties.

While work is in progress during the day, the signs can be placed at required points. When the construction crews knock off for the day, the operator rotates the fore and aft legs so that they align with the fixed legs, then sets the sign out of the way. The signs are replaced where required when the construction crew comes back on duty. When not in use the signs stack in a compact pile. Stands and signs are always together.

•

Portable Transformer Carts



WEATHERPROOF transformer cart supplies power for welding and other airplane service work

WHEELED TRANSFORMERS supply lighting and the several types of power required in service work on planes at Moffett Field, Calif., Naval Air Station. Dry-type transformers serve 120 v for lighting and portable tools, 208-v three-phase and 480-v three-phase power to the various receptacles on the panelboard. Carts are fed by a four-conductor, rubber-covered cord from 480-v three-phase outlets. The fourth wire grounds the metal frame of the cart and provides the connection for the ground conductors in all cords served from the carts. Being weatherproof, the carts are also used out-of-doors for welding and other service work on planes.

Look to Locke for Distribution Materials...

Wireholders

for instance...

This is a Locke No. 0611-44 wireholder — one of a complete line—for installing secondary circuits on poles and buildings.

The hardware is accurately formed to fit the porcelain, and has *Permazinc*—Locke's *Quality Controlled* double hot-dip galvanizing—for extra years of dependable performance. Screw threads are sharp and clean for easy installation.

The wireholder is so designed that, when load is applied, the porcelain is in compression for maximum strength. Porcelain is *Compression Glazed*—an original Locke process—for added strength. Hardware and porcelain are designed together and made together to work together.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Get in touch with your Locke representative.

Depend on Locke for *Quality Controlled* distribution materials—pole line hardware and insulators. *One* order covers *both*.

Locke POLE LINE HARDWARE and INSULATORS

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

LOAD BUILDING

"Teen-Agers" Study Electrical Living

BOBBY-SOXERS (left) jam classrooms to hear about the joys of working in an all-electric kitchen. Four "young hopefuls" learn how to make "goodies" for future parties

INFORMATION about living electrically is so keenly sought by Chicago bobby-soxers that Commonwealth Edison Co (sponsor of eight summer classes) has found it necessary to double the number of sessions. Originally it was intended to hold sessions on Tuesday and Thursday morning, but the enrollment was so heavy that Monday and Wednesday classes have been added.

More than 210 are registered and attend sessions regularly. On the schedule of classes are: "Short-Cuts to Housekeeping," a program featuring the correct use and care of appliances; "Breakfast Time Cooking"; "Simple Meals and Snacks"; "Pastries and Desserts;" "Cakes and Cookies;" "Entertaining at Home"; and "Decorate with Light."

• • •

Planned Lighting Is Unobtrusive

PEOPLE VISIT a furniture showroom to look at furniture, not at lighting fixtures. This was the thought on which T. T. Peake, Georgia Power Co lighting engineer; Ivey & Crook, architects; and Fulton Bros Electric Co, contractor, cooperated in the planning of lighting for the store of the Rhodes Furniture Co, Atlanta, Ga.

The result appears in the picture. The lighting of the room makes no claim on eye attention; the goods displayed are seen first. Ten rows of recessed troffers, 7½ ft apart, supply a maintained intensity of 45 ft-c. Each row contains 12 troffers of two 40-w lamps. Wattage is 3.3 per sq ft. Adding in windows, showcases and the sign outside, the lighting of this store totals a load of 20.4 kw.

UNITED STATES RUBBER COMPANY

SERVING THROUGH SCIENCE

I JUST KEPT LOOKING UNTIL I FOUND IT!

Laytex (Type RU) branch circuit wire is *different*—and *better.*

It is smaller in diameter than any other rubber insulated building wire. It's lighter in weight—easier to handle.

Furthermore—it is insulated with 90 per cent unmilled, grainless natural rubber, and has perfectly centered conductors.

And last—but not least—it leads the field in physical and electrical properties.

RU wiring with RU?

Small diameter • Light weight • Natural rubber insulation Perfectly centered conductors • High tensile strength • High dielectric strength • Flame retardant, moisture resistant cover

UNITED STATES RUBBER COMPANY
1230 Avenue of the Americas • Rockefeller Center • New York 20, N.Y.

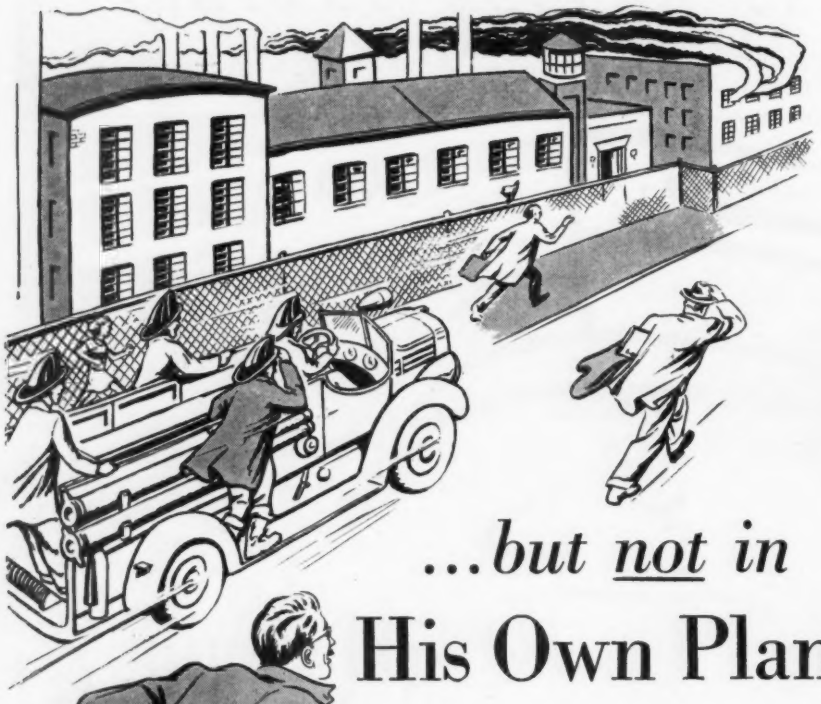
U.S. LAYTEX

U.S. Laytex

Reg. U. S. Trade Mark

ELECTRICAL WIRES AND CABLES

Everybody loves to see a fire



...but not in His Own Plant

There's something exciting about a fire, but when it's your property, that's another story. Stop fires when they start with C-O-Two fire equipment. Prevent costly damage. C-O-Two is clean, modern, carbon dioxide fire protection. It's versatile; C-O-Two is used to protect electric and flammable liquid hazards of every size. It is non-conducting, non-deteriorating, harmless to the most delicate instruments.

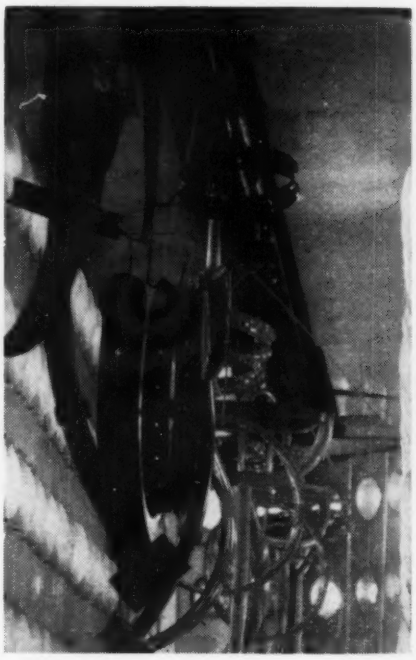
See that your plant has C-O-Two protection. Check your dip tanks, bake ovens, spray booths, rheostats, switch panels, and other electric equipment. Don't overlook blueprint and record vaults. Then write us for a catalog or let one of our expert representatives help you plan complete C-O-Two fire protection.

C-O-TWO

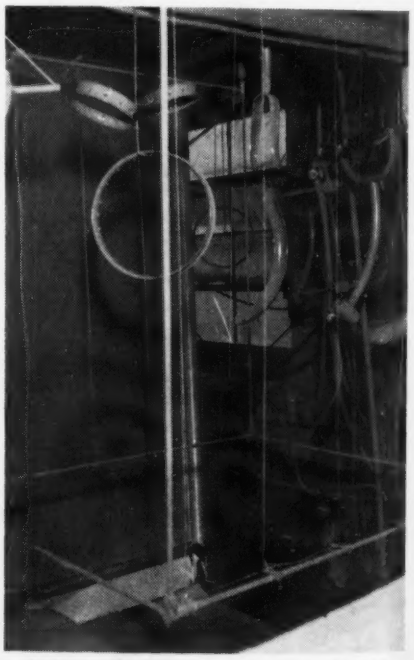
C-O-TWO FIRE EQUIPMENT COMPANY
NEWARK 1 NEW JERSEY
Sales and Service in the Principal Cities of United States and Canada
Affiliated with Pyrene Manufacturing Company

Painting Electrically Speeds Production

ELECTROSTATIC PAINTING—not a large electric power load in itself—may, nevertheless, be an important cog in production that does build load. When combined with conveyors, power presses, induction heating and infrared drying to speed



1 Mist-fine paint particles are charged electrically and attracted to the negative potential of the metal parts carried through this booth by conveyor. The electrostatic paint process speeds production and saves labor



2 On into the drying tunnel, with 360 infrared lamps, and in seven minutes the parts are ready to continue along the assembly line

New! Improved!..

BLACKBURN *Pole Bottom* GROUND PLATE

REA Approved

How to Order:

See your Jobber and specify BLACKBURN Pole Bottom Ground Plate.

Catalog Number GP-100
(Made in 1 size only)

Shipping Weight: 40 lbs. per 100

Patented

Stop in and Inspect Our Plant When You Are in St. Louis

3 BIG QUALITY FEATURES!

1. Supplied with double bar connector (one bar on each side of plate). These double bars grip wire tightly and positively—ground wire will not pull off or loosen as pole is set in hole.

2. It's stronger—more rigid—easier to handle—easier to store—easier to install—send for sample and see for yourself!

3. Connector screws are made of high strength Duronze—will not season crack—can be installed tightly without stripping or distorting.

You get all these features and others too—at no additional cost—so specify BLACKBURN Pole Bottom GROUND PLATES!

SEND FOR A SAMPLE AND SEE FOR YOURSELF!

FIRST, MADISON & CLINTON STS. • **JASPER BLACKBURN PRODUCTS CORP.** • ST. LOUIS 6, MISSOURI

BUILDERS OF QUALITY PRODUCTS FOR 15 YEARS!

CRESCENT

ABC Armored Cable

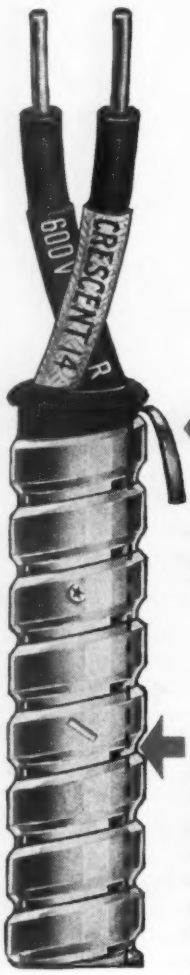
Has These Improved Features Which Result in

INCREASED SAFETY

and

LOWER COST

●



Bond Strip Under Armor

Permanently low armor resistance **is provided in sizes No. 14 and 12 AWG by use of a flattened bonding wire which is in contact with the under side of each convolution. These sizes now are smaller and lighter, since they use the smaller diameter Type R conductors of the 1947 National Electrical Code.**

Prefabricated Break Lines

The Cut Mark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge — a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

The Armored Cable Industry is celebrating its 50th Anniversary. In the last 20 years alone over SIX BILLION FEET of Armored Cable have been installed.

CRESCENT
WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

production, the faster painting becomes essential to full use of additional power.

This has been proven in the experience of Kansas City Power & Light Co power sales engineers at the J. E. Donalson Manufacturing Co plant in North Kansas City.

Scooter, tricycle and sidewalk bicycle parts are moved through the plant in a continuous conveyor system to final assembly rather than by the traditional box lot process. Faster painting and drying permit the new finishing assembly to move four times as fast as former hand-spraying methods.

All shapes of metal parts are moved through the paint booth by a conveyor which is grounded and attracts electrically charged paint particles from a field of fine wire. Supply to the booth is from a Ransburg Electrostatic high-frequency machine with an output of 130,000 v direct current. Input to the machine is 60 cycles, using 5 amp at 200 v. Complete and uniform coverage is obtained with 40 to 50 percent savings in paint compared to the hand-spraying technique that was formerly used in this manufacturing plant.

●

Corn Drying Requires 175 Kwhr per 1,000 Bu

More than 125 farmers served by utility companies in Northern Illinois will safeguard their 1947 corn crop by utilizing forced air drying. Power consumption will vary in each installation depending upon the temperature and humidity of the air and the moisture content of the corn. However, past experience indicates that about 175 kwhr per 1,000 bushels of corn produces a storable grain. Demands vary from 9.4 amp on ¾-hp, 110-v, single-phase motors to 27 amp on 5 hp on 220-v, single-phase installations.

Sizes of the motor and fan are dependent entirely on air requirements. These in turn vary with size of the bin and depth of corn in it. Roughly speaking, the total air requirements per square foot of bin floor range from 30 cfm with corn 4 ft deep to 90 cfm with corn 9 ft deep. The accompanying table lists intermediate values.

Forced-air corn-drying is about the

protect poles and cross-arms with this clean treatment

CLEAN

NO OFFENSIVE ODOR

NON-BLEEDING

EASY TO HANDLE

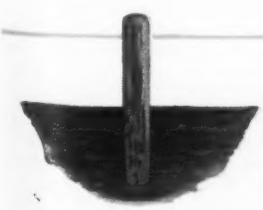
Poles and cross-arms given the *tested protection* of Pentachlorophenol withstand severest exposure conditions—and repay you many times in long life and serviceability. This modern wood treatment is *clean* . . . there's no offensive odor . . . it's non-sticky, easy to handle. And this protection is economical.

Applied in low concentrations in petroleum oils, Pentachlorophenol gives maximum service when applied by conventional pressure and non-pressure methods—but can be sprayed or painted on standing poles with effective results.

Giving new life—and long life—and at the same time cutting maintenance costs, Dow Pentachlorophenol is the *modern* protection for structural timber. It's the *clean* treatment!

For further information, talk to your treater—or call on Dow.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN



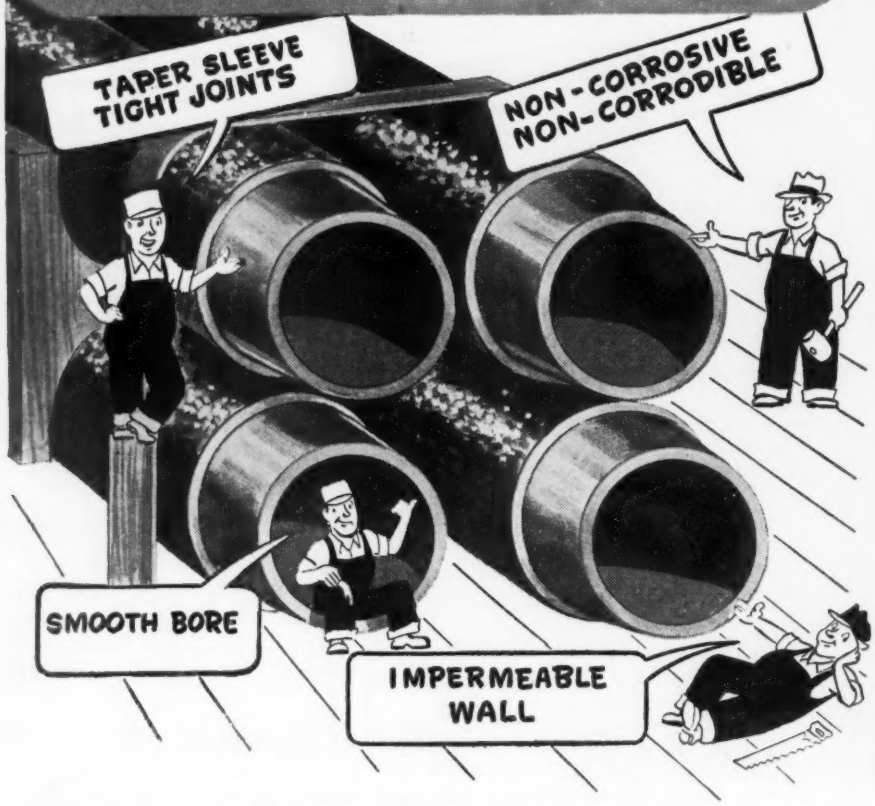
Look at this record of resistance to termites and decay!

Only two of 99 Pentachlorophenol-treated yellow pine posts in accredited Mississippi test plot showed any damage after ten years, despite termites and soil moisture. None were removed as unserviceable. All of 33 untreated posts were destroyed by decay or termites after an average life of 3.2 years.

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

Will your cable be safe from SCORING? INFILTRATION? CORROSION? STRAINS?



House the cable in ORANGEBURG Conduit and it will be safe! *Safe against* SCORING *and* STRAINS . . . because ORANGEBURG'S *smooth bore* protects sheath from scoring or abrasion as cable is pulled into duct; reduces pulling tension and cable strain; makes longer pulls possible. *Smooth bore* and *less friction* also reduce wear with cable movement under load. *Safe against* INFILTRATION *and* CORROSION . . . because ORANGEBURG'S *impermeable walls* and *tight* TAPERWELD *joints* keep out ground waters and corrosive elements. Write *today* for the interesting, fully informative ORANGEBURG Catalog.

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.
Graybar Electric Co., Inc. • *Distributors* • General Electric Supply Corp.

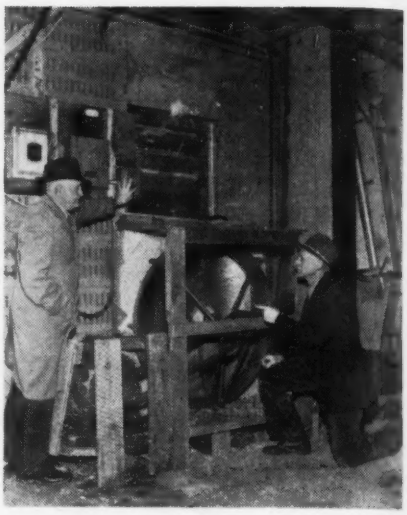
ORANGEBURG FIBRE CONDUIT

*Reg. U.S. Pat. Off.

THE FIBRE CONDUIT CO. REG. U.S. PAT. OFF. ORANGEBURG N.Y.

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.



AIR FOR DRYING is blown through 3,000 bu of corn by this 42-in., 5-hp fan and motor combination. It operated 6 hours per day for 10 days and one full day just prior to shelling. Crop was later sold as No. 1 grade

AIR DUCT made of snow fence and short 2 x 4's carries 9,000 cfm of air into corn. A 5-hp motor is used on this installation

same as hay drying. The corn is placed in a crib which has a built-in duct. Unheated air is forced into the duct by the fan and passes through the stored corn. Moisture content of the ears is reduced from around 30 percent to the safe storage value of about 18 percent.

TABLE I—Air Requirements Per Sq Ft of Bin Floor

Corn Depth (ft)	Cfm
4	40
6	50
8	60
10	75
12	90

TABLE II—Motor Size Required for Fans

Air (cfm) at 1 in. Static Pressure	Motor Hp
3500	¾
7000	2
12000	3
15000	5

Get PERFORMANCE *plus* PROTECTION-- *with* Wagner RURAL-LINE TRANSFORMERS

TYPE HEF-5

Select the type that meets your requirements from Wagner's COMPLETE line . . .

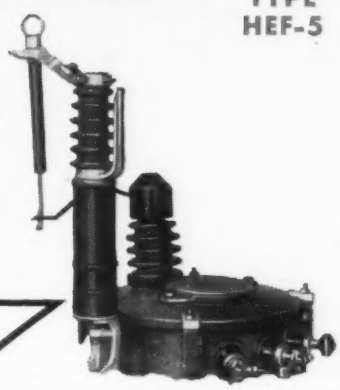
When you install pole-type transformers on your rural line, you naturally want to be sure they will provide dependable, efficient service. You also want them to be protected as fully as possible against damage by lightning, surges, and overloads, in such a manner that a transformer can be put back in service quickly and easily if an outage occurs.

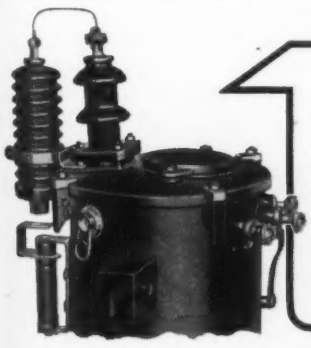
Wagner rural-line transformers are establishing enviable records in the field, upholding the Wagner reputation for dependability earned during our half-century of designing and manufacturing distribution and power transformers. The Wagner line is complete, and offers a selection of types with protective features to meet your specific needs.

Protective Features of the Wagner Type HEF-5 Rural-Line Transformer

TYPE HEF-5. Double "bird-proof" gap provides surge protection; internal fuse forms a protective link between the transformer and the high voltage line. When the double gap and internal fuse are combined no other surge protection or transformer fuses are required.

TYPE HEF-7
Joslyn Lightning Arrester provides surge protection; primary fuse provides protection against overloads. A blown fuse can be replaced without removing the tank cover or bushing, which reduces the time required for putting the transformer back in service.





TYPE HEF-3
De-Ion Gap on high-voltage side provides surge protection; secondary circuit-breaker protects transformer against secondary short-circuits and overloads. Breaker reset handle is easily accessible; on sizes 5-kva and above, a warning signal light is built into the reset handle.

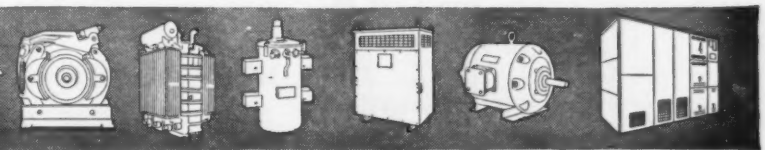
Wagner rural-line transformers are also available in the conventional type HEF, to which specified protective devices can be added. All types meet REA requirements. In addition, Wagner manufactures a complete line of substation transformers for rural-line distribution service.

Your investment in Wagner transformers is protected, too, by Wagner's nationwide organization for providing fast, convenient service. Wagner's 29 branches, located in principal cities, are ready to help you with your transformer problems.

For further information on Wagner Rural-Line Transformers, write for Bulletin TU-1C. Wagner Electric Corporation, 6456 Plymouth Avenue, St. Louis 14, Missouri.

Consult Wagner Engineers on All Transformer Problems

Wagner Electric Corporation
EST. 1891

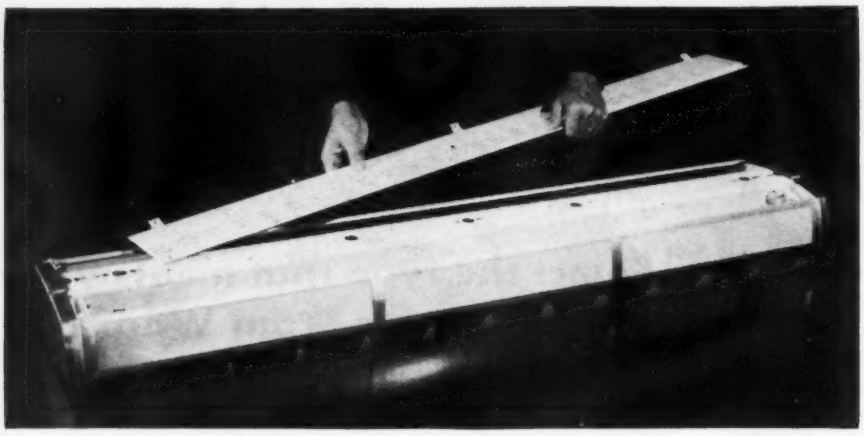


T47-3

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

NEW EQUIPMENT



Fluorescent Unit

THE GRENADIER, a two-lamp semi-direct unit, has been redesigned in keeping with post-war developments in lighting technique, according to the manufacturer, F. W. Wakefield Brass Co, Vermilion, Ohio. Modifications include increased shielding of 35 deg parallel to the lamps and 25 deg normal to the lamps. Easier maintenance is provided by removable side panels and louvers. The downward component of illumination may be increased by accessory opaque reflectors or by slotted reflectors placed immediately above the lamps. Other improvements include heavier gage metal, whiter plastic side panels, and a new exclusive finish. Cost of the new fluorescent unit is stated by the manufacturer to remain approximately the same.

•

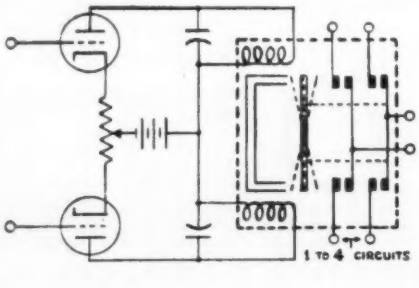
3-Position Relay

FOR relay-terminated control circuits and servomechanisms, a new 3-position or null indicating polarized relay is offered by Sigma Instruments, Inc, 70 Ceylon St, Boston 21, Mass. This unit has a flexible contact structure of up to a maximum of four normally open circuits for each polarity (total of eight) having power handling capacity comparable with light to medium duty switching relays.

When the coil is provided with two opposed windings for use in a push-pull output circuit, minimum differential power requirements are approximately 0.005 watt per contact pole, and operation is entirely unaffected by variations in "stand-by" current. With a single-wound coil, about 0.0025 watt is needed per contact pole.

The armature, which is almost exactly balanced, has "snap-action" centering or detent, and does not move gradually with increasing coil current. About 25 grams of force at the contacts are available from an input of 0.005 watt, and a similar amount of holding the central or null position, with input balanced or zero. The magnetic circuit being polarized, these forces increase directly with current up to nearly 200 grams.

Contacts, which may be ganged in double-break or paralleled pair arrangement, are rated at 5 amp, 110 v a-c, nominal each. Open or hermetically sealed types are offered.



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HF-FM Radio Set

A COMPACT, crystal controlled, FM transmitter and receiver with dry battery power supply is a new unit in hand-carried communication sets developed by Motorola, Inc, 4545 Augusta Blvd, Chicago 51, Ill. This FM Handie Talkie is stated to have a weight of only 7 lb and provide reliable communication in excess of 2 miles between units. This range is increased when working with central station or mobile units.

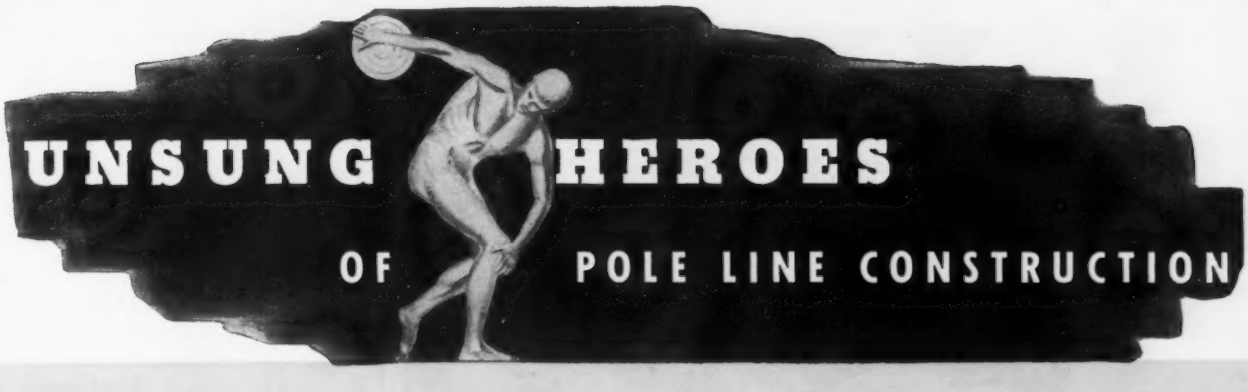
The unit has a superheterodyne circuit and is designed to operate in the 25-44 Mc band. Less than one microvolt will produce 20 db quieting in the output. Power output of the transmitter is 0.6 watts. The handset or earphones of the receiver will operate on 2.5 milliwatts.

•

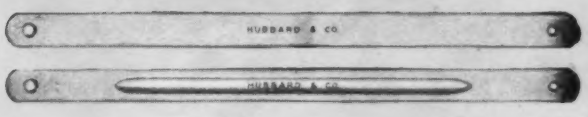
A-C Inert-Arc Welder

A NEW Type WP 220-440-v a-c welding transformer designed specifically for use with the Inert-Arc welding process has been announced by the Electric Welding Division of the General Electric Co, Schenectady, N. Y. While especially suitable for welding aluminum, magnesium, and beryllium copper in an atmosphere of argon gas without the use of flux, the new welder may also be used to weld a wide range of other metals and alloys. It is suitable for both manual and machine operation.

Built into a single compact unit are welding transformer, control panel, capacitors for power-factor correction, a bank of series capacitors to stabilize the arc, a pilot spark circuit for arc starting, and water and gas solenoid



Simple things, CROSS ARM BRACES, just a strip of flat steel with a hole punched in each end, but most important to a pole line. Hubbard Braces are fabricated from the best, new, open-hearth steel and all corners are rounded to protect linemen from sharp projections. For the engineer who wishes additional strength on the compression side of the arm, the ribbed brace is provided and offers approximately 25% added protection.



HUBBARD FLAT AND RIBBED CROSS ARM BRACES

HUBBARD ANGLE CROSS ARM BRACES, for heavy construction, are supplied in a range of spreads and drops to meet the requirements of any standard construction. Angle size runs from 1½ to 2-inches. At the pole attachment hole, the angle is so formed that wrench clearance is provided. Attachment is by ⅝-inch Machine Bolt at the pole and ½-inch Carriage Bolts at the arm.

HUBBARD ANGLE CROSS ARM BRACE

DRIVE POINT MACHINE OR CROSS ARM BOLTS are roll-threaded to provide a "finger-fit" for the full length of the thread. The "Drive Point" feature enables the bolt to be used as a drift pin for the alignment of holes slightly off center. This operation must be carried out with caution so as not to injure the threads. "Drive Point" also facilitates the application of nuts and allows bolts to be driven out of the pole for reclamation without injury to the threaded end. The major portion of Hubbard bolts of all types have this feature.

HUBBARD DRIVE-POINT CROSS ARM OR MACHINE BOLT

HUBEYE BOLTS are furnished for attachments of any kind where a thimble would normally be used. The eye of the bolt is drop-forged to a shape which provides a perfect "built in" thimble. Strand may be looped around the Hubeye with complete protection. Side walls of the eye retain the roundness of the strand. There is no possibility of kinks or strains at the loop. Hubeyes are a thoroughly tried and proven product.

HUBEYE DRIVE-POINT BOLT

STANDARD HUBBARD OVAL-EYE BOLTS are an old line item still much used in many sections. Hubbard Eye Bolts are all drop-forged with an eye that is stronger than the shaft of the bolt. Made from the best, new, open-hearth steel and Hubbard Double-Dip Hot Galvanized.

HUBBARD OVAL-EYE DRIVE-POINT BOLT

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND
CALIF.

Kilowatts on the night shift

The best new workers on your night shift are General Electric Automatic Blankets.

When most appliances knock off for the night, these automatic blankets go to work—*real load builders for your off-peak hours.*

Over half a million enthusiastic people are using General Electric Automatic Blankets today—and every two blankets use just as many kilowatt hours as one six-foot refrigerator.

We're telling *your* customers the exciting story of these blankets through full-color advertisements in *Life, House Beautiful, Good Housekeeping, Time, This Week,* and *National Geographic.*

You profit when you tell them, too.

Tell them that the original General Electric Automatic Blanket is now available in three models.

Tell them about the exclusive new Two-Control Automatic Blanket for double-bed luxury.

Tell them about the wonderful One-Control Blanket—and the brand-new Twin-bed size.

Because every one of these blankets in your area means more kilowatt hours on *your* night shift.

Write to us for full information, *today.* We'll give you all the tips on how to cash in on this great load builder. Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Conn.

Approved by Underwriters' Laboratories, Inc.

GENERAL ELECTRIC

valves. The entire assembly is enclosed in a drip-proof case, with electrical terminals and gas and water connections brought out to convenient outlets. An indicator scale on the front of the welder shows the current setting. Welding current is controlled by turning a handle on top of the welder.

The pilot spark operates for only a fraction of a second during starting of the arc. A special control circuit shuts it off as soon as the arc starts, in order to prevent objectionable radio interference during welding.

In order to synchronize and control the operation of the pilot spark, gas and water solenoid valves, and a striking of the arc, a control panel has been built into the welder. After initial adjustments are made on the panel, all components of the welder are operated by means of a simple foot treadle. This allows the operator to devote his entire attention to the welding operation. The welders can be mounted on a 3-wheel running gear.

•

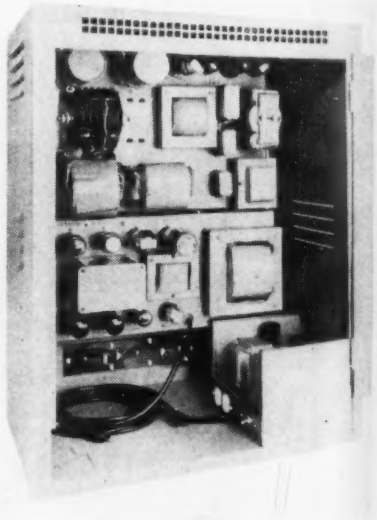
Voltage Regulator

A NEW VOLTAGE REGULATOR, Model E-3006, designed to provide a regulated source of d-c voltage and current especially applicable for testing of instruments, has been announced by Sorensen & Co, Inc, Stamford, Conn.

The unit measures approximately 3 ft high, 2½ ft wide, 18 in. deep. Physically the unit is divided in half. The upper half is a modified Nobatron with the following qualifications:

Input voltage range, a-c	95 to 125
Output voltage, d-c	6
Load range, amp	7½ to 15
Regulation accuracy, %	0.1
Ripple voltage, rms max, %	0.5
Recovery time, sec	0.2
Input frequency range, cps	50 to 60
Ambient temperature range, deg C	—50 to +50

The lower half contains a regulated



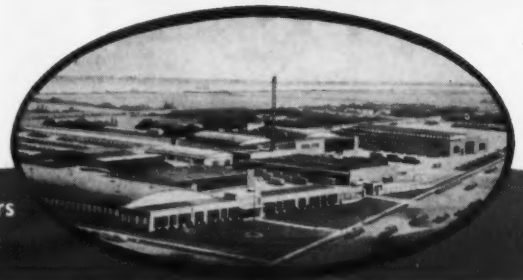
Series 500 Line Construction & Maintenance Body. Write for complete information

ALL-STEEL

POWERS

PUBLIC UTILITY BODIES

STANDARD of SERVICE for Line Construction and Maintenance Work



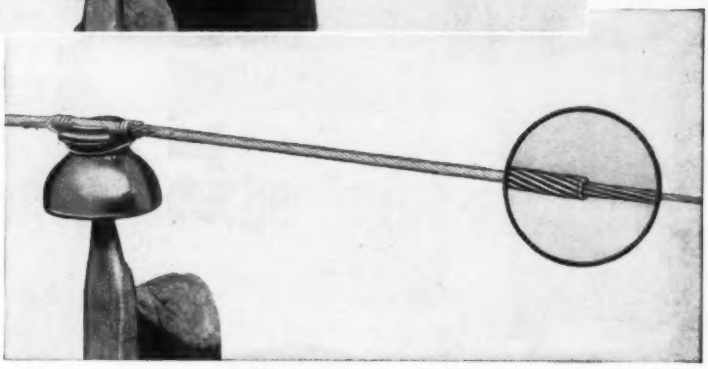
Over 75 years experience!

LINE BODIES • POLE TRAILERS • BRUSH TRAILERS • GENERAL SERVICE BODIES

McCABE-POWERS AUTO BODY CO., 5900 N. BROADWAY, ST. LOUIS 15, MO.

PREFORMED ARMOR RODS

Quickly, easily applied



SAFE-GUARD CONDUCTORS AT LOW COST

1. Reinforce conductors at supports
2. Dampen vibration
3. Minimize wear
4. Protect against arcing
5. Increase holding power
6. Reduce corrosion

Preformed Armor Rods provide a dependable, economical way to reinforce and protect overhead conductors and static wire at the point of and in the region of the support. They minimize wear and chafing, tend to absorb and dissipate vibration, protect the conductor against arcing and flashovers, reduce the possibility of corrosion, provide excellent holding power against slippage.

Easily and quickly applied by hand or with "hot-line" tools. Available in galvanized steel, aluminum, copper or bronze.

Write for Descriptive Bulletin, No. PR-100.

INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

d-c power supply with these characteristics:

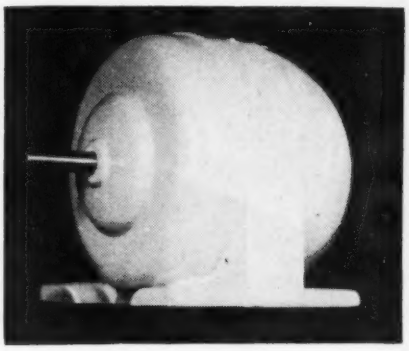
Input voltage range, a-c	90 to 135
Out voltage, d-c, cont	0 to 300 adjustable
Load capacity, ma	100
Regulation accuracy, %	0.1
Input frequency range, cps	50 to 60

The input voltage of the regulated d-c power supply has been made stable and accurate, it is stated, through the use of a Sorensen Model 150 which controls the input line voltage. As a result the output is kept at its setting without variation.

•

Fractional HP Motors

NOW AVAILABLE in ¼, ⅓, ½ and ¾ hp, new induction motors are manufactured by Electra-Motors, Inc, 1110



North Lemon St, Anaheim, Calif. Weight is stated to be reduced approximately 50 percent through simplified design and high-tensile-strength alloys. The motor is of the continuous duty, dripproof type, 3 phase, 60 cycle, 220/440 v, 1,200, 1,800 and 3,600 rpm.

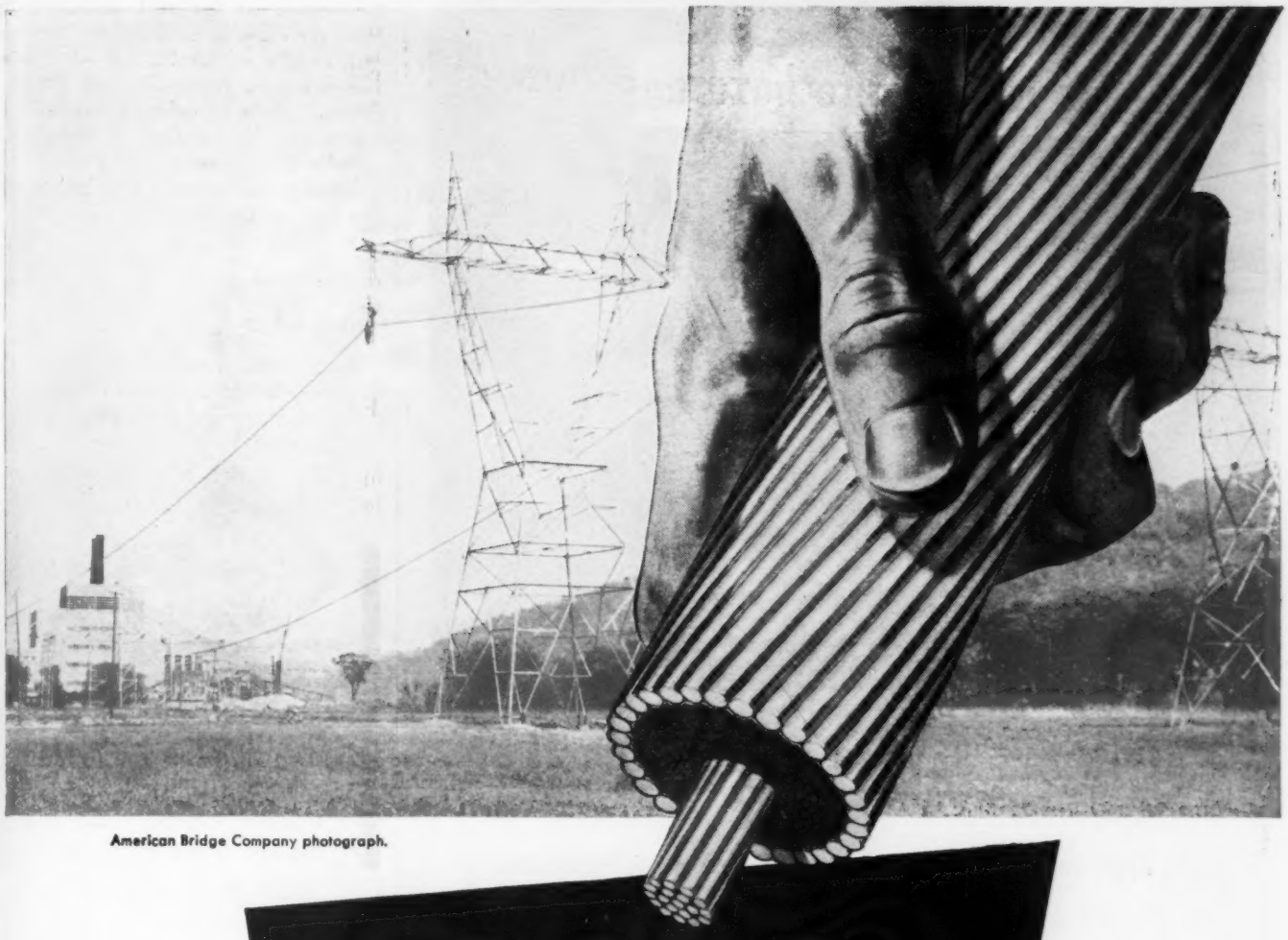
Some features follow. Bearings are double-sealed and lubricated for life. Shaft end-play is restricted to a minimum. Both stator and rotor cores are easily accessible. Positive ventilation is provided by "TempTrol" design. The motor can be operated both vertically and horizontally. Its clean lines are of interest to machine designers wherever a motor is exposed to view. Base has slotted holes for belt adjustment. Load-bearing frame is one-piece, providing for precision bearing alignment.

•

Portable Cable Reel

BY THE DEVELOPMENT of a self-feeding cable reel, McColphin-Christie Corp, Dept A-23, 4922 South Figueroa St, Los Angeles 37, Calif., has a portable unit for the extension of power outlets on construction jobs, in welding shops, factories and hangers. The reel consists of a drum, a 4-wheel cart, an extendable towing bar, and a bar handle to pull the unit and to act as a drag to prevent over-running.

According to the manufacturer, a



American Bridge Company photograph.

A·C·S·R
that's engineered for the voltage

A 7500-ft. circuit of Alcoa Expanded ACSR is now under test at voltages up to 500 kv on the experimental test line of The American Gas and Electric Company near its Tidd plant, Brilliant, Ohio.

Alcoa engineers drew on the service records of 50 years of experience and 1½ million miles of ACSR in operation to design a new, *high*-voltage conductor to maintain ACSR's record on the nation's high lines.

ALUMINUM COMPANY OF AMERICA, 1978 Gulf Building, Pittsburgh 19, Pennsylvania. Sales offices in 53 leading cities.

MORE PEOPLE WANT MORE ALUMINUM FOR MORE USES THAN EVER

ALCOA A-C-S-R
ALUMINUM CABLE STEEL REINFORCED

—here's how to SAFEGUARD it!

Apply carbon dioxide with a *Kidde* Total Flooding System

You'll find *Kidde* Total Flooding Systems as fast and sure in safeguarding oil storage and reclamation rooms as they are in protecting electrical equipment.

Automatically or manually operated, a *Kidde* Total Flooding System fills the entire threatened area with carbon dioxide to the point where fire *cannot* exist. In twenty seconds or less, the blaze is completely extinguished!

And a *Kidde* System is *always* ready for action. No pumps or other power sources needed for operation. No recharging needed except after use. No maintenance except a simple periodic weight check.

Remember . . . carbon dioxide is dry, inert, speedy, clean.

Ask a Kidde representative for the full story!

Walter Kidde & Company, Inc., 1030 Main Street, Belleville 9, N. J.

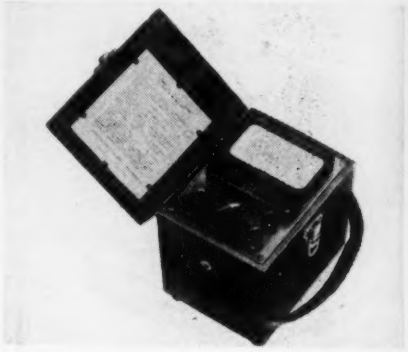
The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

guide arm on the reel automatically feeds the cable in even layers. The reel will handle up to 325 ft of 1⅝-in. diameter cable (approximately 700 lb). For example, a 4-conductor cable of No. 2 wire can be handled. A female receptacle is mounted in the hub of the reel and a male plug is attached to the free end of the cable.

•

Ohmmeter

MODEL 246 ohmmeter is the latest addition to the instrument line produced by Associated Research, Inc, 231



South Green St, Chicago 7, Ill. It contains two No. 6 dry cells for power supply.

This instrument has precision wire-wound resistors and 4½-in. hand stepped scale. It can be used for checking accurately resistors as low as 1 ohm and up to 100,000 ohms on four overlapping scales of 0-100 ohms, 0-1000 ohms, 0-10,000 ohms, and 0-100,000 ohms. A metal of wrinkle-finished case with cover protects the instrument, also holds the dry cells. Over-all dimensions are 7¾ in. x 6 in. x 7⅛ in.

•

Shaded Pole Motor

A 4-POLE shaded-pole motor, designated type "T" and sold under trade name Micromotor, is built in sizes from 1/25th to 1/100th hp. Manufacturer is Redmond Co, Inc, Owosso, Mich. It has a three-piece, die-cast frame with a steel outer shell enclosing the air-stream cooling system.

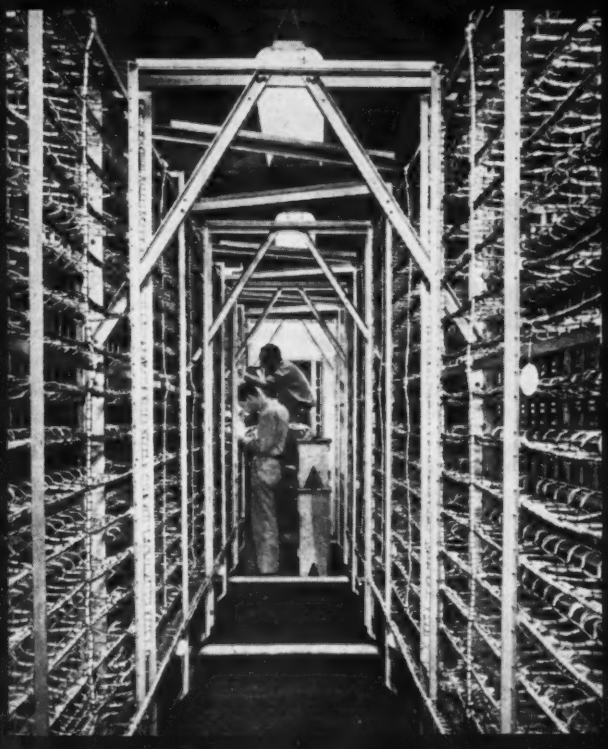
In the flush-weld rotor, every slot is copper filled flush with surface, precision skewed and welded, the surface is machined and rust inhibited, and the assembly accurately balanced. Windings are highly resistant to oil or atmospheric conditions, it is reported.

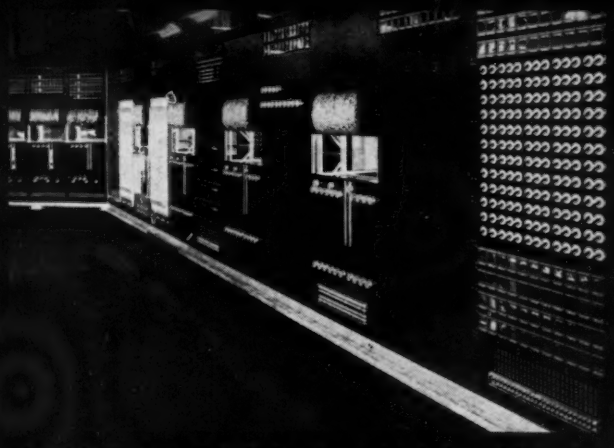
Large porous bronze bearings are broadly spaced. Each bearing is individually fitted to shaft at close tolerances and spring tension centered. Oil return is accomplished by oil slingers and oil retainers. An unusually rigid

WORLD'S LARGEST

ELECTRIC "BRAIN"

IS WIRED WITH— DELTABESTON*





A million feet of Deltabeston wire is laced into the world's largest calculator, the Navy's Mark II, at Harvard University. Deltabeston wires carry information from one "brain cell" to another, from the time a problem is set up until solutions are reached.

Answers traveling along its intricate circuits have got to be right every step of the way. That's why Deltabeston wires were selected for this job.

Why is it that Deltabeston wires and cables are so often the choice for installations that need something extra in wiring protection — where the emphasis is on doing jobs right? Above all, it's Deltabeston's well-chosen insulation — designed in a full range of styles to beat ambient heat and conductor heat for installations of all types. In addition, Deltabeston's flexibility makes it easy to handle, easy to work with on intricate jobs, without injury to insulation. And features like toughness, abrasion resistance, and moisture resistance help make it the choice for tough jobs. For unusual jobs, there are wires and cables with special features in the complete, heat-beating Deltabeston line.

Let us send you information on beating your heat problems with Deltabeston wires and cables. Write to Section Y93-1027, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.

DELTABESTON

wires and cables

Silicone-treated cables • aircraft wires
hook-up wires • power cables
appliance wires • fixture wires and cords
magnet wires • locomotive cords

built to beat the heat

GENERAL ELECTRIC

something NEW in tool belts

"KLEIN-LINE" TOOL BELT

with the sliding trace

The "Klein Line" Tool Belt—new in design—provides increased comfort and convenience and a maximum factor of safety to the lineman.

The distinctive feature of this new belt is the Sliding Trace. Made of "Klein-Kord" (the same proved material used in our safety straps), the Sliding Trace is mounted on the cushion and carries the drop-forged tested single bar Dee rings. The trace slides freely through alloy steel guides, allowing movement of approximately 6 inches in either direction. Thus, the lineman is relieved of chafing often caused by conventional belts, and undue safety strap wear is prevented.

Other construction features of the new "Klein-Line" Belt include: 2-inch wide heavy harness leather belt strap with drop-forged buckle; 1-inch wide harness leather tool loop strap securely riveted to the main strap; and 4½-inch wide cushion of pliable latigo leather with rolled edges and canvas interlining. All sewing is lock stitched with hot waxed linen thread—all rivets solid copper hand set. Furnished complete with plier pocket, tape thong and knife snap.

Ask Your Supplier

Foreign Distributor: International Standard Electric Corp., New York

A copy of the Klein Pocket Tool Guide, showing the Klein line and containing valuable tool information, will be sent on request.

KLEIN TOOLS EST. 1857 TRADE-MARK REG.

Mathias KLEIN & Sons

Established 1857 — Chicago, Ill., U.S.A.

5200 BELMONT AVENUE, CHICAGO 18, ILLINOIS

base is provided by multiple curvatures formed in heavy-gage pressed steel. The motor is cradled in large live rubber cushions held firmly in place by strong steel cups.

•

Strain Relief Bushing

A TWO-PIECE molded assembly made from nylon forms a strain relief bushing made by Heyman Manufacturing Co, Kenilworth. N. J. This insulating Heyco bushing is said to withstand temperatures up to 400 F and, having a vise-like grip, absorbs push, pull and torque without injuring the insulation or wire. It eliminates tying knots in the lead-in wire.

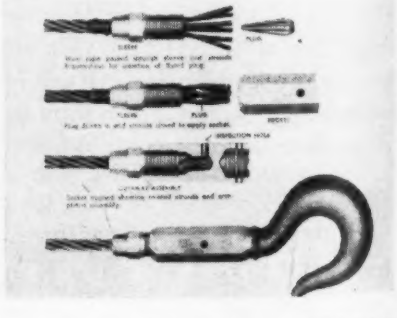
To install, one section of the bushing is placed under the wire; the other section is placed over the wire, squeezed in place with pliers made for the purpose, and the assembly is snapped into the hole of the appliance. Assembly rate is reported to be 400 or more per hour. Five sizes are available for wire types POSJ, POT, S, ES, SJ, SV and heater cord.

•

Hook-End Fitting

A NEW HOOK-END fitting which it is claimed will replace unsafe and makeshift methods is being introduced by the Electroline Co, 4121 South LaSalle St, Chicago 9, Ill., manufacturers of a line of wire rope, strand and cable connector products.

On winches, cranes, hoists, derricks,



THERE IS A GENERAL QUICK AID FIRE GUARD for EVERY FIRE HAZARD

Whatever your fire hazard—oil, gasoline, chemicals, textiles, paper, grease, wood, electrical equipment, etc.—there is a QUICK AID FIRE GUARD to fight it. There are five different types of QUICK AID FIRE GUARDS: vaporizing liquid, carbon dioxide, foam, soda-acid, and non-freeze. Each is quickly effective.

Don't take chances. Get QUICK AID FIRE GUARD for every fire hazard.

IF IT'S GENERAL IT'S DEPENDABLE

Wherever you are, there is a GENERAL dealer nearby. Without obligation, he will help you select the right QUICK AID FIRE GUARD for every fire hazard. Look for the GENERAL trade-mark in the classified section of your phone book, or drop a line to GENERAL in Detroit.

THE GENERAL DETROIT CORP.
DETROIT 7, MICHIGAN
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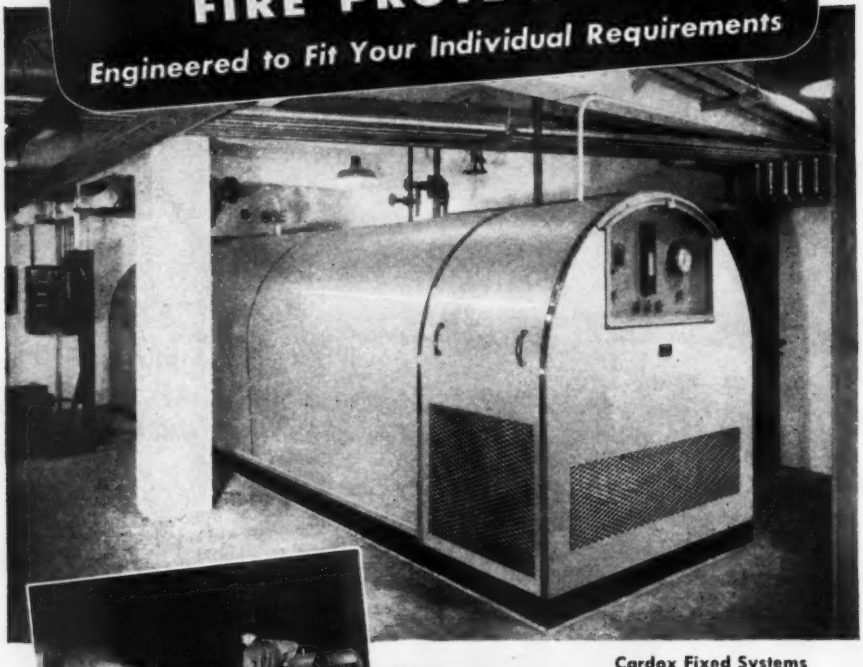
TORONTO • MONTREAL

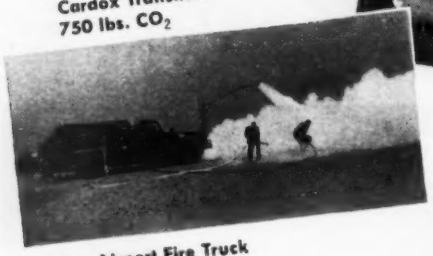
CARDOX
FIRE PROTECTION
Engineered to Fit Your Individual Requirements



Cardox Fixed Systems

Cardox Transitank*
750 lbs. CO_2

Cardox Fire Trailer*
750 lbs. CO_2 . . . 32 gal. Foam solution



Cardox Airport Fire Truck

Cardox Fire Truck

Cardox engineered applications of low-pressure carbon dioxide give this fast-acting, non-damaging medium new effectiveness in conquering fires, large or small, both indoors and out.

Whether the hazard or combination of hazards calls for *500 pounds* or *125 tons* of Cardox CO_2, a single Cardox System . . . with its compactly designed, centrally located Storage Unit—can be engineered to meet the *specialized* or *varied* fire problems involved. Cardox Mobile Units for indoor or outdoor protection put wheels under 750 pounds to 3 or more tons of carbon dioxide for instant use in any part of the property. Utilized individually or in planned combinations, Cardox Fixed Systems and Mobile Units have given new scope to all the recognized advantages of CO_2 fire protection. Write today for Bulletin 5107 and recommendations for Cardox engineered protection for the tough fire hazards that worry you.

*Now available in many localities

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices: New York • Philadelphia • Pittsburgh
Cleveland • Detroit • Los Angeles • San Francisco
San Diego

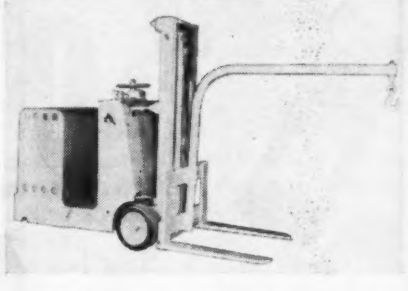
CARDOX CO_2 FIRE EXTINGUISHING SYSTEMS

draw works and other similar equipment, hooks may now be secured safely and quickly to the wire rope ends by means of the Electroline-Fiege connector which is built as an integral part of the hook. Applied with common tools and easily checked through an inspection hole, the manufacturer claims that the assembly will stay on forever or can be easily removed if desired. A vibration damping effect prolongs the life of the wire rope, eliminating the need of frequent re-socketing. The forged steel hook is available in stationary or swivel types for ten wire rope sizes between ¼ in. and 1 in. inclusive.

•

Crane Arm

A NEW CRANE arm attachment to fit all models of the company's power fork trucks has been made available by



Lewis-Shepard Products, Inc, 301 Walnut St, Watertown 72, Mass.

This arm is built to a minimum length of 24 in. and in increments of 6 in. to a maximum length of 72 in. It can be mounted between two forks and may be operated as a separate unit or in combination with the forks.

Material to be handled with the crane arm is picked up with a sling attached to the crane hook. After the load is secure it can be moved by the crane arm or placed on a pallet or skid platform for transportation by means of the fork. The attachment permits the operator to handle transformers, motors, warp beams in and out of looms, as well as reaching into vats, gondola cars, and presses.

•

Soldering Iron

NEW ELECTRIC soldering iron, especially suitable for fine soldering of instruments, electric appliances, and radios, is an addition to the line of Hexacon Electric Co, 206 West Clay Ave, Roselle Park, N. J. It operates from 110- or 220-v a-c or d-c circuits.

This Cat. P-30 iron can be furnished with removable ⅛-in. or ¼-in. diameter copper tips and in 40, 50 or 60 watts. It is equipped with a 6-ft heater cord

Reduction of Utility Accounting Costs

THE proportion of your pay roll which is incurred for accounting and clerical work is a surprisingly high figure. Directly or indirectly "paper work" reaches constantly into every department. Under the constant pressure of mounting costs, utility managements must look to simplification and improvement in methods to help offset increased wage and salary rates.

EBASCO accounting consultants are prepared to assist you with organization surveys and studies of your customer billing and accounting methods, general accounting procedures, budgetary control systems, etc., for the purpose of cost reduction.

A complete outline of EBASCO'S individualized service to top-management is contained in the brochure "The Inside Story of Outside Help"—a guide to successful outside help in your business and industry. Your copy on request.

EBASCO SERVICES INCORPORATED

TWO RECTOR STREET, NEW YORK 6, N. Y.

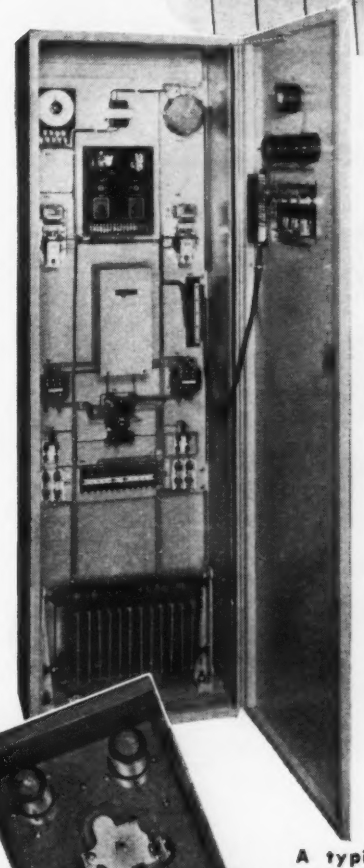
Engineers — Constructors — Business Consultants

SERVICES OFFERED—Accounting • Appraisal • Budget • Consulting Engineering • Design & Construction • Financial • Industrial Relations • Inspection & Expediting • Insurance • Purchasing • Rate & Pricing • Research • Sales & Marketing • Tax • Traffic

✓ Boost your load factor
✓ Increase your revenue
✓ Improve customer service
✓ Use

THE IMPROVED METHOD OF PEAK LOAD CONTROL

PEAK-TROL



Now you can add more off-peak loads! Peak-Trol operates on an entirely new principle. You are unhampered by any predetermined time schedule. Peak-Trol drops off-peak loads when peaks come . . . picks up off-peak loads (automatically or manually) when peaks pass.

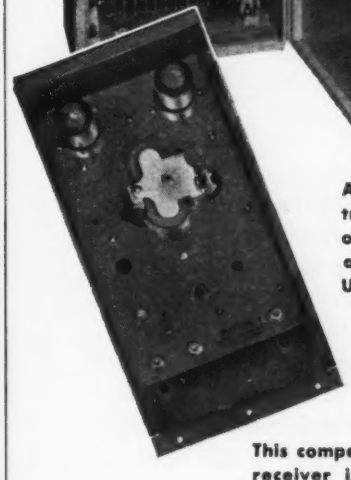
Peak-Trol is ideal for controlling:

- Water Heaters
- Street Lighting
- Residential Heating
- Deep Freezers
- Milk Plant Cooling
- Certain Industrial Loads

Now you can add more of these loads and boost your load factor, without increasing installed capacity. At the same time, you can increase your revenue.

Peak-Trol operates any time, day or night. This gives maximum use of water heaters with safety to the power system and results in increased customer satisfaction.

WRITE for <u>new</u> bulletin just released!



A typical Peak-Trol transmitter. Automatic or manually controlled as desired. Compact. Uses very low wattage.

This compact Peak-Trol receiver is located at each off-peak load site. Only one moving part. Built for long, trouble-free service.

NEW 8 PAGE PEAK-TROL BULLETIN
No. TA-1 tells about the new principle of operation. Shows a typical application to a power system. Write for your free copy today!

CONTROL CORPORATION

719 CENTRAL AVE. • MINNEAPOLIS 14, MINN.

*REG. U. S. PAT. OFF.

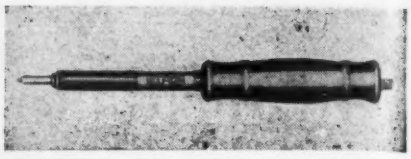
DESIGNED and built to provide maintenance men with practically everything necessary for electrical resistance measurements from a fraction of an ohm up to 1000 megohms, the "Bridge-Meg" type of "Megger"* instrument combines in one compact, *portable* unit the facilities of a "Megger" Insulation Tester and a Wheatstone Bridge.

You'll find the "how and why" of the "Bridge-Meg" Insulation and Resistance Tester described fully within the profusely illustrated pages of this Bulletin of the Month. *Your* copy is waiting. No obligation, of course. Send *today* for Bulletin 21-60—W.

JAMES G. BIDDLE CO.

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.



and rubber plug. Heating elements are nickel-chromium resistance wire and can be replaced.

TECHNICAL LITERATURE

Wire Manual—A 263-page "Manual of Technical Information," containing wire, conversion, and mathematical tables; code data; properties of materials; and typical engineering calculations, is available from Rome Cable Corp, Rome, N. Y., at $2.50 per copy. It covers aluminum, copper and steel wire; solid and stranded; bare and insulated.

Boilers—"Boilers and Combustion 1946," publication No. 0-13, is a report of the boilers and combustion subcommittee of the prime movers committee, EEI, which is available from the Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. It contains information on boiler failure outage rate, boiler pressure and non-pressure parts, pulverizers, burners, flow of coal, combustion control, and acid cleaning boiler internal surfaces. Copies are $1.00 for members, $1.50 for USA non-members, and $2.65 for foreign mailing.

Cable—A joint report of committee on power distribution, Association of Edison Illuminating companies and the EEI T & D committee entitled "Cable Operation 1944" is available from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. Report covers experience on 14,000 miles of cable operating above 7.5 kv. Copies are 60 cents to members, $1.50 to non-members in USA, and $1.60 when sent to foreign countries.

Lighting Handbook — "Westinghouse Lighting Handbook," Revised Edition, price $2, obtainable from the advertising and sales promotion department, Westinghouse Lamp Div, Bloomfield, N. J. This revised version of the company's first lighting handbook, published in 1943, has a completely revised lighting design section. Unlike the design chapter of early version, this edition uses the coefficient of utilization method of calculating illumination. This step brings the handbook in working agreement with what is virtually the standard system of calculation used by the industry. The chapter also includes a unique and very usable table for pre-calculating footcandle values. With it lighting engineers can predict performance of interior lighting installations with a minimum of figuring.

Standards—Second Edition of Steam Jet Equipment Standards is obtainable from Heat Exchange Institute, 90 West St, New York 6, N. Y.; price $1 per copy. The book contains recommended nomenclatures, definitions, performance, capacity, construction, standard units, standard accessories. It has three parts: Steam jet ejectors; Test code for steam jet ejectors; Steam jet vacuum refrigeration equipment.

Electric Cooking—"How You Can Sell More Commercial Electric Cooking Equipment" is the title of a 64-page manual available from Electrical Information Publications, Inc, 124 South Carroll St, Madison 3, Wis.; price $2.50 per copy. This manual provides a description and care of numerous cooking devices, a chapter on restaurant kitchen layout, and wiring capacity table.

NEWS ABOUT PEOPLE

C. K. Graham New President of Indiana Association

C. K. Graham, commercial manager of the Southern Indiana Gas & Electric Co, Evansville, was elected president of the Indiana Electric Association at the recent meeting at French Lick.

Mr Graham obtained his early experience with the Springfield Light, Heat & Power Co at Springfield, Ohio, now a part of Ohio Edison Co, as meter tester, trouble shooter, lighting and power engineer.

C. K. GRAHAM

In 1930 he was transferred to the Southern Indiana Gas & Electric Co and at the present time is in charge of commercial and sales activities.

•

▶JAMES WILSON, president of the Shawinigan Water & Power Co, Montreal, has been elected chairman of the company's executive committee, succeeding the late Gordon W. MacDougall.

▶HENRY W. SMITH has been appointed assistant chief engineer of the engineering division of the B. C. Electric Railway Co, Vancouver. Mr Smith, who joined the company about two years ago, was superintendent of station electrical engineering department, electrical division. He went to the B. C. Electric from the Toronto Hydro-Electric system. CECIL G. MILLS has been appointed to the position vacated by Mr Smith. He was formerly protection and communications engineer. Mr Mills became identified with the company a year ago, after an association with the West Kootenay Power & Light Co in Trail, where he was electrical engineer. CLAIRE B. CAMPBELL has been made protection and communications engineer. He joined the B. C. Electric more than a year ago. Prior to service in the navy, he was with the Hydro-Electric Power Commission of Ontario.

•

Central Maine Power Elects Schnurle Vice-President

Harold F. Schnurle of Portland, Me., has been elected a vice-president of the Central Maine Power Co. He will direct the utility's public relations program and represent it in some of its industrial development activities. He joined the company in 1936 and has since served as assistant to the president.

H. F. SCHNURLE

Mr Schnurle has been a state senator and served two terms as a governor's councillor. For eight years he was chairman of the Maine Development Commission, and he has been chairman of the Maine Division of the New England Council.

•

▶C. R. LANCASTER has been elected president of the Broad River Rural Electric Cooperative, Inc, Gaffney, S. C., succeeding C. A. GRAINGER, resigned. Mr Grainger had been president of the cooperative since it was organized seven years ago.

Streit Made Chief Engineer, Columbus & Southern Ohio

Heading organization changes recently announced by the Columbus & Southern Ohio Electric Co, Columbus, Ohio, is the appointment of Frank H. Streit to the position of chief engineer.

F. H. STREIT

Fred Campbell has been named assistant chief engineer.

The distribution department of the Columbus area has been consolidated with and will operate as a division of the engineering department. Charles H. Stump will head this division and serve as district engineer.

Engineering offices of the southern area will also be consolidated with and operate as a division of the engineering department, with headquarters at Athens, Ohio. Leland Krieg will head this engineering division and serve in the capacity of district engineer.

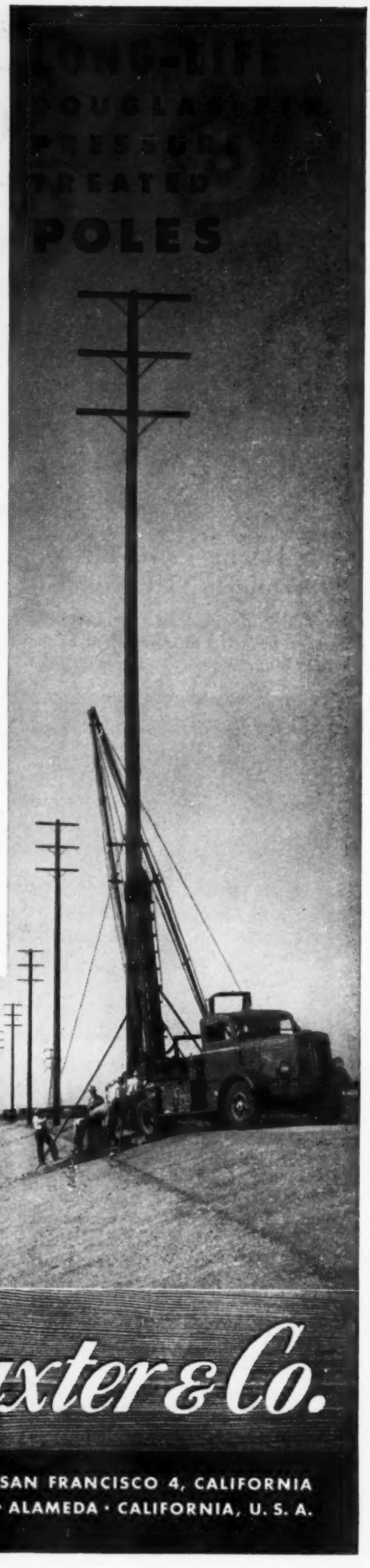
Walter A. Smith has been appointed plant superintendent of the Floodwood generating plant, succeeding W. H. Badger, retired. T. A. May has been appointed superintendent of the new construction and maintenance department of the southern district with headquarters at Middleport.

Mr Streit has been chief design engineer of the company for almost a year, and Mr Campbell assistant design engineer during the same period.

•

▶CRAWFORD GORDON, JR., has been appointed president of the English Electric Co. of Canada, Ltd., St. Catherines,

BAXCO



In transmission lines–distribution, lighting or telephone systems–wherever dependable service is of prime importance you can count on Baxco Long-Life Poles to do the job.

Baxco Long-Life Poles are strong, straight, machine shaved, Coast-type Douglas Fir pressure treated with creosote and pentachlorphenol to resist rot, termites and deterioration.

You'll be proud of these poles in your line and more than satisfied with their long maintenance-free service. Write or wire us your inquiries.

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Ont. ANDREW S. TAIT has been appointed chairman to succeed D. H. McDOUGALL, who is retiring as chairman, but who will remain a director.

•

Rinke Made Chief Engineer of Potter & Brumfield

Appointment of James F. Rinke as chief engineer of Potter & Brumfield Manufacturing Co, Princeton, Ind., has

J. F. RINKE

been announced. The company at the present time is engaged in an extensive program for development of a number of new types of relays.

Mr Rinke goes to P & B from Electronic Laboratories, Inc, Indianapolis, where, for the past five years he was in charge of all general laboratory activities in connection with the development of special vibrator-type power supplies and converters for a wide variety of applications. Previously he was connected with the engineering staff of Meissner Mfg Co, Mt. Carmel, Ill.

•

► H. A. GLOVER has been appointed assistant sales manager of S&C Electric Co, formerly Schweitzer & Conrad, Inc, Chicago. A graduate of the Carnegie Institute of Technology, Mr Glover for a number of years was occupied with various electrical engineering duties with the West Penn Power Co, Duquesne Light Co and Carnegie-Illinois Steel Corp in Pittsburgh. Later, while in the sales department of the I-T-E Circuit Breaker Co, Philadelphia, his business career was interrupted by three years' service overseas in the U. S. Navy. He jointed S&C as sales department supervisor in 1946. Mr Glover is a member of the Association of Iron and Steel Engineers.

► E. B. FINN, district sales manager, Insulation Manufacturers Corp, Cleveland, Ohio, and B. F. McNAMARA,

technical director of the corporation in Chicago, have been appointed vice-presidents of the company. Mr Finn has been with the company since 1927, and Mr McNamara since 1930.

•

J. G. Rainey Made Sales Manager of Moe-Bridges

Announcement has been made of the appointment of J. G. Rainey as sales manager of Moe-Bridges Corp, She-

J. G. Rainey

boygan, Wis. formerly connected with the General Electric Co in a merchandising capacity. Mr Rainey will have charge of the merchandising program for Moe-Bridges' expanding line of fluorescent lighting fixtures and electrical appliances.

•

▶Harry M. Dexter has been appointed sales manager of the Continental-Diamond Fibre Co., Newark, Del. Mr. Dexter, formerly in charge of the Cleveland sales office, has transferred his activities to the main office in Newark.

▶C. D. Grady has been appointed assistant superintendent, electrical department, Union Electric Co, St. Louis. In his new capacity he will assist the electrical department superintendent in the operations of the line, substations, meter and engineering departments at East St. Louis and Alton. Mr Grady has been with the company since 1921. At the time of his recent promotion he held the title of construction engineer.

▶Dr Louis C. McCabe, chief of the Coal Division, U. S. Bureau of Mines, has been appointed chief engineer and director of air pollution control for the County of Los Angeles. A graduate of the University of Illinois, Dr McCabe served with the Illinois Geological Survey for eleven years prior to the

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All Voltages—115 to 13,200 Volts

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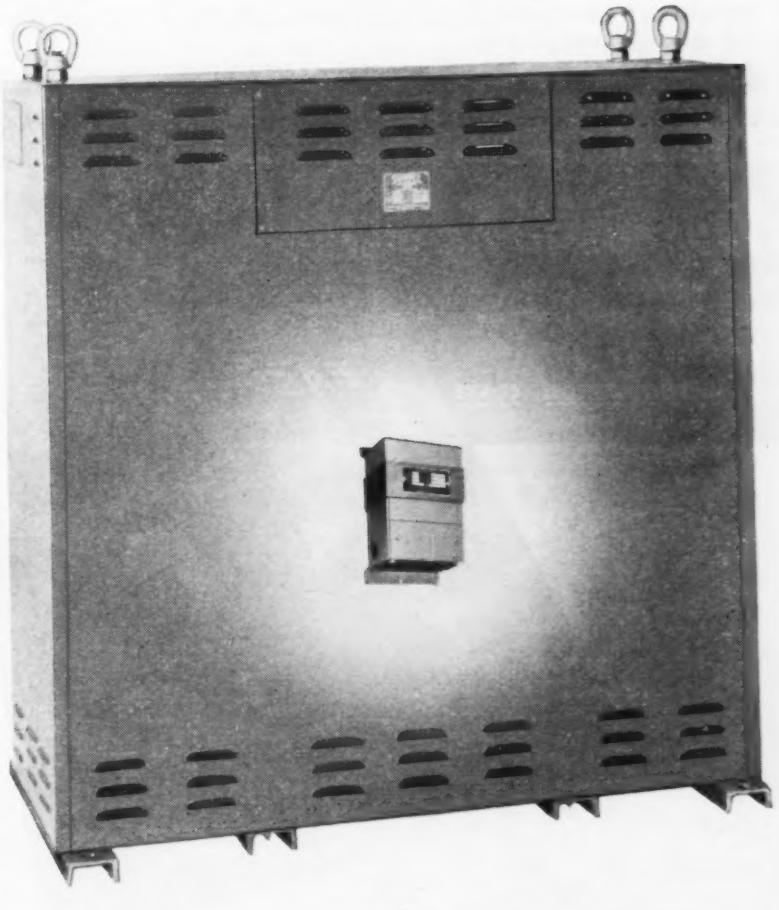

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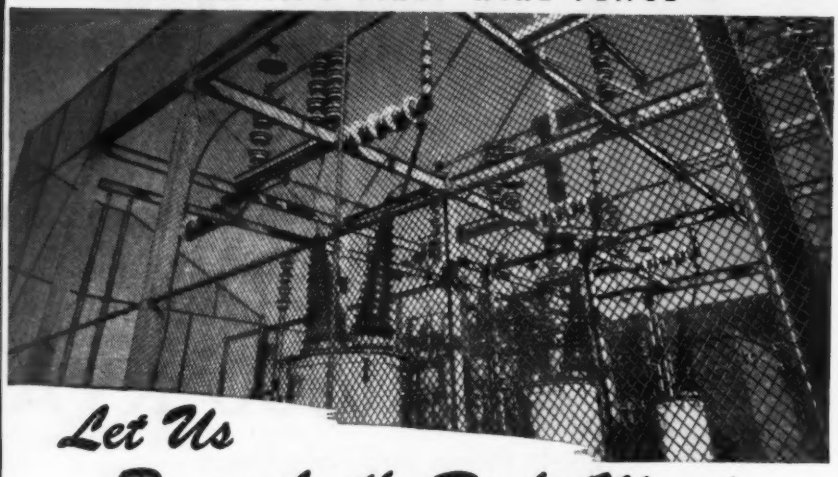

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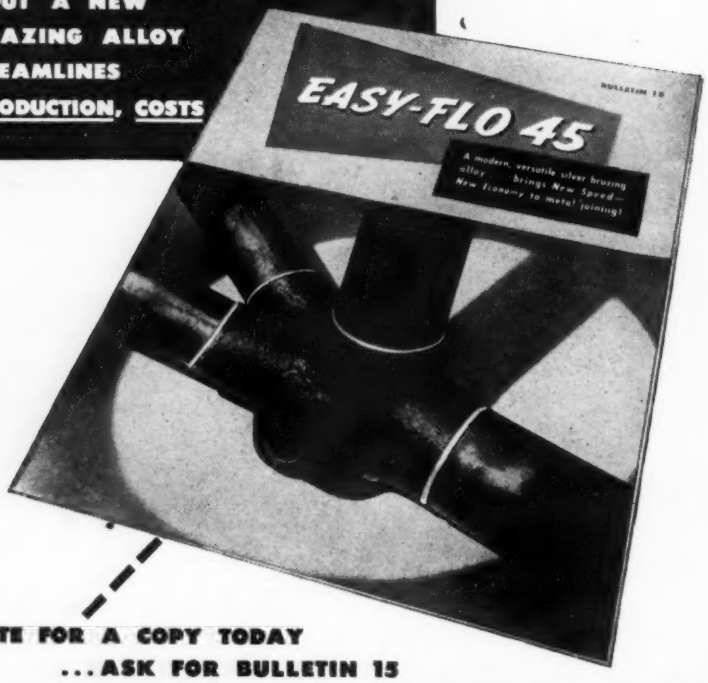
FACTS ABOUT A NEW SILVER BRAZING ALLOY THAT STREAMLINES DESIGN, PRODUCTION, COSTS



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war. During the war he served as chief of the Utilities Branch of the War Department, and later was in charge of the fuels division of the Army of Occupation in France.

•

N. H. Hawkins, Jr, Assumes Broader Executive Duties

N. Hawthorne Hawkins, Jr, vice-president and manager of transportation of the Birmingham (Ala.) Electric Co, has been made vice-president in charge of operations. Details of Mr Hawkins' career were published when he was elected a vice-president earlier this year (ELECTRICAL WORLD, May 24, page 182).

J. M. Reynolds, formerly executive assistant, has been made assistant to the president.

Howard G. Ford succeeds Mr Hawkins as manager of the company's transportation department.

•

▶ J. RYAN BINGAMAN, formerly manager of power sales for the central division of the Metropolitan Edison Co, located in Reading, has been promoted to the position of manager of industrial development for the entire Metropolitan Edison System. His office will be located in Reading. PAUL A. KINSEY, formerly director of rural development for the system, has been made division sales manager, central division. Mr Kinsey will be in charge of all sales activities of the company, including industrial, commercial and residential sales forces in the central division.

▶ CHARLES E. SHEVLING has been appointed resident engineer for Seattle (Wash.) City Light at Ross Dam, succeeding H. F. FAULKNER, retired. Mr Shevling has been assistant to Mr Faulkner since 1943. Mr Faulkner retired once before, in 1940 after reaching the mandatory retirement age of 65, but was called back in 1943 to be resident engineer for the second step of Ross Dam. He has been aiding in construction of City Light dams since 1927. Mr Shevling will be assisted at Ross Dam by ROBERT P. SONNTAG, who moves up from office engineer.

▶ SCHUYLER MERRITT, 94 years old, has resigned as a director of Yale & Towne Manufacturing Co after serving 70 years on the board. Mr Merritt joined Yale & Towne in 1877. The following year he was elected to the board and also secretary of the company. Later he served sucessively as treasurer, vice-president and chairman. He held the chairmanship from 1925 to 1932. Yale & Towne

had one plant in Stamford, Conn., and employed 200 persons when Mr Schuyler first joined the company. Today it employs 10,000 and has eight plants in the United States, Canada and England.

•

New Assignments Made by Gulf States Utilities

Gulf States Utilities Co, Beaumont, Tex., has recently announced several new appointments.

J. B. Hodge, who for the past 14 years has been located at Baton Rouge, first as sales manager of the Baton Rouge Electric Co and, after the merger with Gulf States, as sales manager for the Louisiana territory, has been appointed operating manager of the Port Arthur division. In this newly created position, Mr. Hodge will be responsible for supervision of all departments of the company's operations in Port Arthur, Nederland, Port Neches and other communities in the south end of Jefferson County.

C. F. Contois, who has been superintendent of industrial sales for the Lake Charles division for the past eight years, was transferred to Baton Rouge where he will serve as sales manager of the Baton Rouge division.

F. F. Johnson, formerly residential sales superintendent of the Lake Charles division for the past five years, has been appointed division sales manager, a new position for the division. In his new position, Mr. Johnson will be responsible for industrial and commercial sales as well as residential and farm sales. The industrial department, formerly headed by Frank Contois, has been combined with the residential sales into one department.

P. J. Guelfi, in charge of industrial sales in Baton Rouge since 1936, has been named assistant rate supervisor for the company and transferred to Beaumont.

•

▶W. W. Hollo has been appointed General Electric representative for wire and cable in the New York district. Mr Hollo joined the General Electric organization at Bridgeport, Conn., in 1935.

•

▶John W. Romig has been appointed assistant general manager of the Champion Lamp Works of Lynn, Mass., covering sales engineering and manufacturing activities. Prior to his connection with Champion, Mr. Romig was sales manager of the technical products division of Corning Glass Works, Corning, N. Y., with which company he had been associated for many years. His

AUTOMATIC STARTERS

for 220-550 Volt Motors

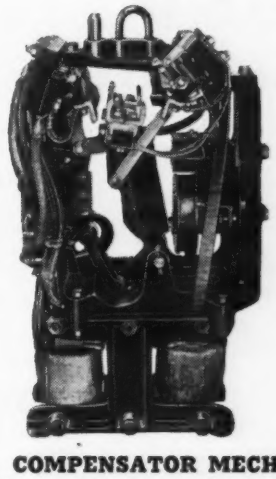
by EC&M

No. 1, 2 or 3 COMPENSATOR

HERE'S a starter that is very popular with operating and maintenance men. It is not an adaptation of contactor-equipment, but a simple, completely wired unit, totally enclosed and oil-immersed in a steel tank.

Total oil-immersion of the compensator-mechanism not only permits interrupting the circuit under oil (recognized as an effective means for breaking alternating currents) but also provides continuous lubrication for all operating parts of the mechanism and protects them from dust, moisture and corrosion.

In over 1000 plants, these EC&M starters have provided fool-proof, dependable operation for a number of years. Ask for Bulletin 1045-B.



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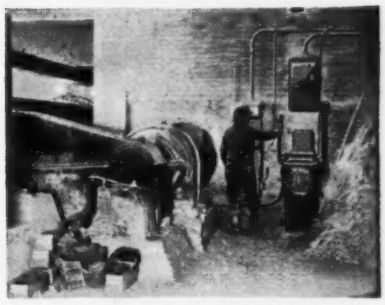
Single, quick-break, double-throw Contactor operated by a *single* magnet. Quick transfer from reduced voltage starting to full voltage running by a throw-over spring and a mechanical latch tripped by a current limit relay.



Push Button operated and mounted near the motor it controls.

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ACCURATE is the kind of tape you'll like to work with. Break open a box on the job . . . note that fresh, clean smell . . . it means tape that's fresh and tacky! Prove it to yourself—apply it to a joint and start taping. See how the tape takes hold on the first turn, doesn't pop off the joint or creep. Tape up hard—ACCURATE tapes can "take it" and give you tight, smooth jobs without splitting or raveling.

When you've finished the joint, see how clean and easy the tape tears off—no loose threads. Yes, you'll find that ACCURATE tapes . . . friction and rubber . . . *do* work with you on the job. So next time you buy tape, try ACCURATE—available in convenient sizes everywhere.

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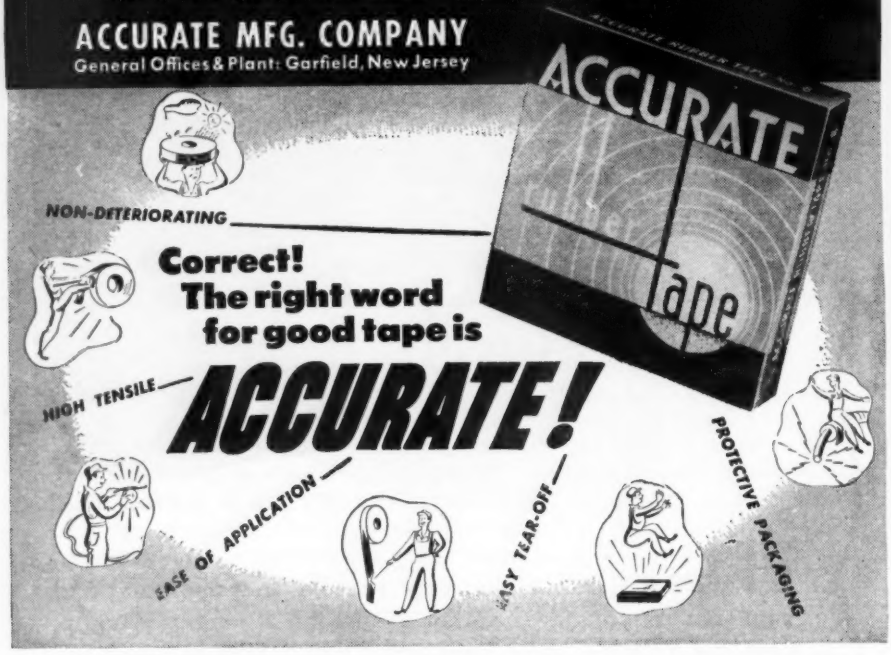

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DILLON
DYNAMOMETER

DEAD ACCURATE
EASY TO USE

Takes out guesswork of "sight and sag", or oscillation wire stringing. Hooked on in a jiffy. Indicates tension in seconds. Measures only 8¼" x 6¼" x 3". Capacities 500 to 20,000 lbs.

The Dillon is universally used in telephone work. Accuracy, and long-lived dependability are the answers. Indicates exact tension in guy strand, messenger and wire.

Many other uses where pull, torque, weight or overload are vital factors.

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previous business experience includes engineering, glass manufacturing and, during the war, regulation and liaison work with the government.

► JAMES P. JONES has retired from his position with the Atlantic City (N. J.) Electric Co. At the time of his retirement he was resident engineer in charge of the installation of a 30,000-kw turbogenerator unit, together with appurtenant boiler, electrical and mechanical equipment. Previous to his work in Atlantic City, he acted as resident engineer in charge of high-pressure boiler-turbine installations for the Indiana & Michigan Electric Co and the Appalachian Electric Power Co, having an aggregate capacity of 300,000 kw. He entered the service of the Appalachian Power Co, Bluefield, W. Va., in 1920, having charge of all construction work. Previous to that he was superintendent for the Logan County Light & Power Co at Logan, W. Va. From 1906 to 1914 he was associated with the Tampa Electric Co and the Mississippi River Power Co. Mr Jones received his early engineering experience at the East Pittsburgh shops of the Westinghouse Electric Corp.

► C. A. ATHERTON has resigned his position with the Reynolds Metals Co, New York, N. Y. From 1925 to the outbreak of World War II, Mr Atherton was technical director of Phoebus S. A., Geneva, Switzerland, an international organization of electric lamp manufacturers which he helped to organize. He previously had been associated with General Electric Co, Schenectady, N. Y., and is the author of "Electric Sign Lighting." At present he is chairman of the handbook committee of the Illuminating Engineering Society and is an official representative on the U. S. National Committee of the International Commission on Illumination.

► H. R. OSBORNE, formerly design engineer. Canadian General Electric Co, Ltd, Peterboro, Ont., has been appointed chief engineer. Mr Osborne was associated with the Westinghouse Electric Corp, East Pittsburgh, Pa., from 1924 to 1930, before joining the Canadian General Electric Co. He is a member of the American Welding Society.

► WILLIAM A. MACDONOUGH, assistant sales manager for General Mills' home appliance department, has been promoted to sales manager.

► FRANK W. WATTS has been appointed general sales manager of the Hart Manufacturing Co, Hartford, Conn. Mr.

Watts joined the company early this year. He was formerly vice-president of Great American Industries, Inc, and general manager of its subsidiaries, Connecticut Telephone & Electric Division, Meriden, Conn., and Rutland Electric Products Division, Rutland, Vt.

▶ORRIN E. DUNLAP, JR., director of advertising and publicity for the Radio Corp of America, has been made vice-president in charge of advertising and publicity.

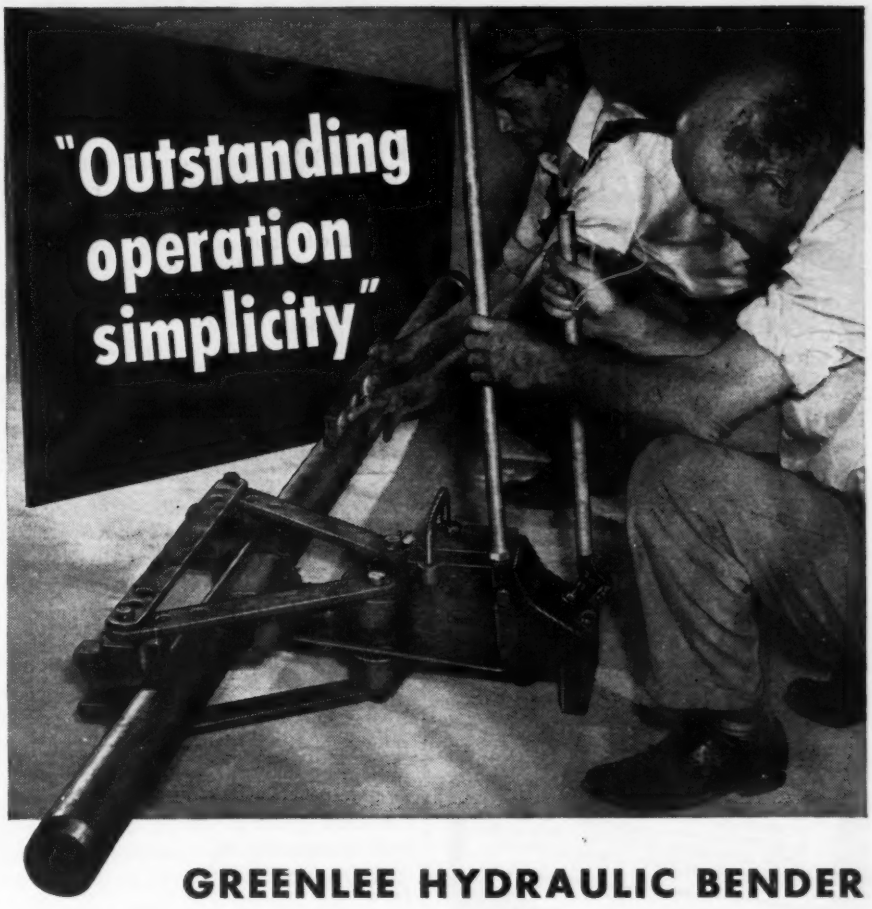
▶WALTER H. VOGELSBERG has been appointed manager of the newly formed equipment division of the Proctor Electric Co. Mr. Vogelsberg was formerly associated with the General Electric Co.

▶FREDERICK J. RUDD, managing engineer of the Motor Engineering Division of the General Electric Co at Lynn, Mass., has retired after 46 years' service. He entered the test course after graduation from Virginia Polytechnic Institute, and after a year was assigned to design work in motor engineering.

▶Merritt Horner, since 1945 sales promotion manager of the Holophane Co, has been appointed sales manager of the national marketing division of Orkil, Inc, with headquarters at Hartford, Conn. Horner's earlier career included five years' service with the General Electric Co at the Edison Lamp Works and a number of years with Connecticut Light & Power Co as illuminating engineer in charge of lighting sales.

▶F. R. ARCHER has been named merchandising supervisor of the fluorescent lighting fixture division of Sylvania Electric Products Inc. In his new capacity Mr. Archer, who has been with Sylvania since 1940, will supervise merchandising and promotional activities for fluorescent fixtures manufactured by the company. Before joining Sylvania, Mr. Archer was affiliated with the Barkon Frink Tube Light Corp as sales engineer and the Westchester Lighting Co as director of lighting promotion and sales for ten years.

▶R. H. ANDREWS, formerly district manager, Philadelphia, of Edwards & Co, Inc, Norwalk, Conn., has been appointed managing director of Edwards of Canada Limited in Montreal. Changes in sales personnel included: C. H. HOLDEN retires on pension, having been connected with the company for 30 years. R. B. SHANNON has been transferred from the Brooklyn-Long Island-Staten Island-Northern New Jersey district to become manager of the Philadelphia office. S. A. KENNEDY suc-



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Here's an important feature GREENLEE Bender users like, and you will too... it's so simple to operate.

That means even the beginner can take a GREENLEE Bender and in *just a few minutes* make smooth, precise bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars.

Owners report labor savings of 50%, 75%, and even up to 90% when the GREENLEE is used in place of old methods of pipe and conduit forming. Material spoilage is reduced to a minimum and big savings are made through the elimination of need for many manufactured bends, fittings, and the work of installing them.

The GREENLEE Bender is one-man-operated, compact, portable, easy to set up...lets you bend conduit exactly where and when needed. Get complete facts on this equipment that quickly pays for itself, does the job faster, smoother, better. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1810 Columbia Avenue, Rockford, Ill.

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Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

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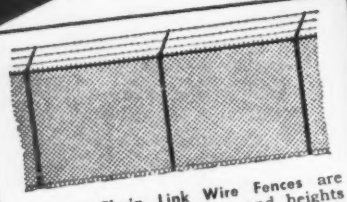
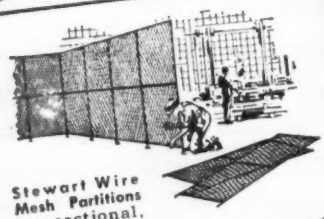
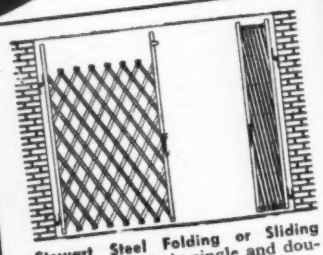
Stewart Wire and Iron Products include many items which are used extensively in the electrical field. Three are illustrated. Others are Iron Picket Fences and Gates; Wire and Iron Window Guards; Machinery Guards; Pipe Railings; All Steel Settees, etc.



Stewart Chain Link Wire Fences are made in several weights and heights to meet all requirements. Style 3TH is shown above. Also made in style 5TH (5 strands of barbed wire) and 0TH, without barbed wire overhang.



Stewart Wire Mesh Partitions are sectional, and made to fit any space. Give all measurements when writing for information.



Stewart Steel Folding or Sliding Gates are made in single and double construction to fit any opening.

Literature sent on request. When writing please mention products in which you are especially interested.

The Stewart Iron Works Co., Inc.
1466 Stewart Block Cincinnati 1, Ohio
Experts in Metal Fabrications Since 1886

Stewart IRON and WIRE FENCES

ceeds Mr Shannon in the Brooklyn-Long Island district. E. A. HARRIS has been appointed supervisor of the sales office in Norwalk.

▶ ONNI LINDFORS, a design engineer in the Electrical Division, Fairbanks, Morse & Co, Beloit Works, has been appointed chief electrical engineer of the company's Freeport, Ill., plant.

▶ CHARLES G. HAMPSON has been appointed sales manager for General Electronics, Inc., and will serve in this capacity at the company's New York office. Mr. Hampson was formerly associated with the sales division of Mykroy, Inc., Chicago.

▶ W. E. BLOWNEY and P. H. KNOWLTON have been named assistant division engineers of the General Electric Turbine-Generator Engineering Division.

▶ GEORGE E. HUBRIC has been appointed southwestern district engineer of the wire and cable department of United States Rubber Co with headquarters in Kansas City. Mr. Hubrig has been associated with the Phillips Petroleum Co since 1938 as senior engineer and staff assistant in the company's Kansas City refinery. In his new position with U. S. Rubber he will have supervision over wire and cable engineering in the company's branches at Kansas City, Denver, Omaha, St. Louis and Tulsa.

▶ W. A. D. EVANS, for six years consultant on electrical discharge lamps in the Administration Division of the General Electric Lamp Department, has retired. After graduating from Columbia University in 1903 with an electrical engineering degree, he joined the Cooper-Hewitt Electric Co in New York. He remained with the company and became president in 1919 when the company became part of the General Electric Co. He continued in the presidency from 1930 to 1939, though the company name had been changed to G-E Vapor Lamp Co.

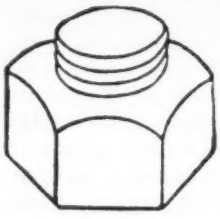
▶ DAVID M. MAYTNIER has been appointed field representative of Tuttle & Kift, Inc, Chicago, in the replacement division. A former district manager of Wheelco Instrument Co, Pittsburgh, Mr Maytnier will have his headquarters in the Chicago office.

OBITUARY

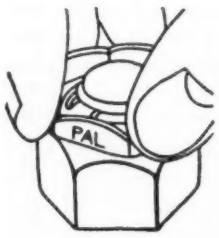
▶ WILLIAM R. BARRETT, assistant division superintendent for Utah Power & Light Co at Salt Lake City prior to his retirement in 1946, died on September 22 at his home in that city. He was 66 years old. A native of Southampton,

Wherever Bolted Assemblies Must Stay Tight

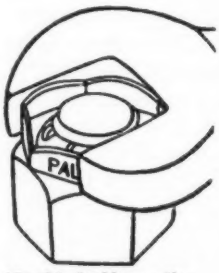
Rely on Double Locking PALNUT LOCKNUTS
—and save cost, too!



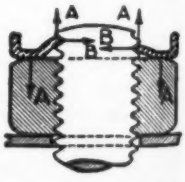
THIS ORDINARY ASSEMBLY, consisting of bolt and regular nut, can be kept absolutely tight in service



. . . WITH THE ADDITION OF A PALNUT LOCKNUT which spins on easily on top of regular nut and



. . . BECOMES A VIBRATION - PROOF ASSEMBLY when the "Palnut" is tightened with a wrench. Double - locking action* keeps bolt and nut secure.



***Double-locking action**
Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

• "Palnuts" are available in full range of sizes, in plain, parkerized, cadmium and hot dip galvanized finishes. Send for samples and literature.

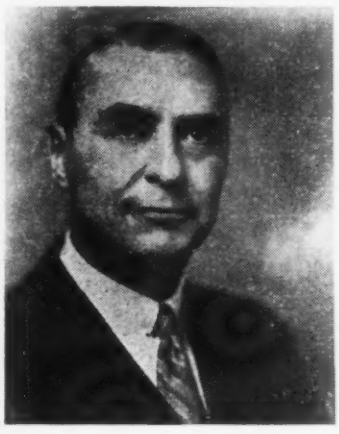
The PALNUT Co.
51 CORDIER ST., IRVINGTON 11, N. J.

England, Mr Barrett received his early education in Canada and went to Utah in the 1900's.

•

Paul A. Schoellkopf

Paul A. Schoellkopf, chairman of the board of directors of the Buffalo Niagara Electric Corp, whose death was announced in the October 4 issue of ELECTRICAL WORLD, page 12, belonged to the third generation of a family that was an integral part of the development of electric power in the Eastern United States. His grandfather, Jacob Frederick Schoellkopf came to this country from Germany in 1842.



Paul was born at Niagara Falls in 1884 and following graduation from Cornell University in 1906 he became associated with his father, Arthur Schoellkopf, as assistant to the secretary and treasurer of the Niagara Falls Hydraulic Power & Manufacturing Co. In 1913, when his father died, Mr Schoellkopf became the company's general manager. This company was one of the predecessors of the Niagara Falls Power Co, which was formed during World War I upon the consolidation of the several developing and power companies. Mr Schoellkopf became its president in 1920, a position he held at the time of his death. When in 1925 the Niagara Falls Power Co joined with other major operating utilities in western New York to form the Buffalo, Niagara & Eastern Power Corp, Mr Schoellkopf was named as its president. He was elected chairman of the board of directors in 1929. In the same year he was made president of the Niagara Hudson Power Corp, which was formed from the consolidations of several major utility corporations serving a large portion of upper New York state, remaining in that position until 1933. When several operating companies of the western division of Niagara Hudson Power were consolidated into the Buffalo Niagara Electric Corp in 1945 he became chairman of the board.

For safety on the "High Line"—

INSULATE WITH INSL-X

E-33

PLASTIC DIP COATING for tools

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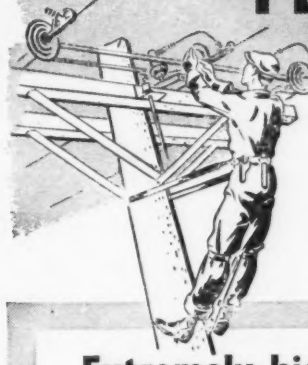
★ WEATHER & MOISTURE RESISTANCE
★ BRUSH, DIP OR SPRAY APPLICATION



Extremely high dielectric strength!

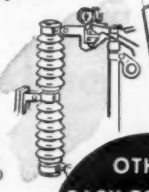
There's no longer any excuse for permitting linemen to take chances with uninsulated tools. INSL-X E-33 dielectric coating quickly insulates any tool at very low cost. Application is easy—simply dip the device to be coated, and hang it up to dry over night. No baking or heating is required—just air dry.

E-33 forms a strong coating that withstands the severest impact and abrasion. It is immune to acids, alkalies, petroleum derivatives and ozone. Dielectric strength of the coating is very high, a factor that recommends its use for insulating every tool used on high tension or other power lines.

INSL-X E-33 not only affords protection for lives but safeguards against short circuits resulting from accidentally dropped tools. Write today for complete details concerning the economy and safety features of E-33 dielectric coating.

ARC PROOF COATING—

The U-95 arc-resistant coating is designed for brush, dip or spray application on phenalic panels and plastic insulation. It withstands short time temperatures as high as 500° F., offers extraordinary arc resistance, adhesion, immunity to solvents and abrasion. Dielectric strength approx. 1800 volts per mil.



BUS BAR COATINGS—

INSL-X E-11 for round bus bars and E-12 for square bars eliminate slow, untidy taping or cambric covering of bars. A two mil coat increases the carrying capacity of a bus 30% over taped bars through increased heat radiation. Dielectric strength is 2000 volts per mil in thin layers.

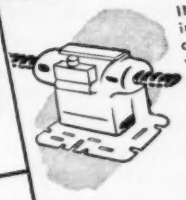
OTHER EASY-TO-APPLY INSL-X COATINGS

FLEXIBLE COATINGS—

E-22 is a highly flexible coat that can be quickly applied by brush, dip or spray. It provides excellent moisture proofing and sealing; features superior mechanical and dielectric qualities. E-22 is ideal for coating metal chassis, cabinets, etc., to eliminate arcing, grounding and corona.

COIL COATING—

INSL-X E-67 is an outstanding coat for protecting current and potential transformer windings. It is not an impregnant but provides a covering of unusual characteristics and mechanical strength. Dielectric strength is high—1100 volts and tensile strength 1000 psi. Application may be by dip or spray.



FUNGICIDAL PROTECTIVE COATS—All INSL-X coatings can be provided with fungicidal properties. Any type of toxicant can be incorporated in INSL-X compounds. The fungicides are water resistant, stable under normal operating temperatures and have high bacterial potency. Concentrations used are harmless to personnel.

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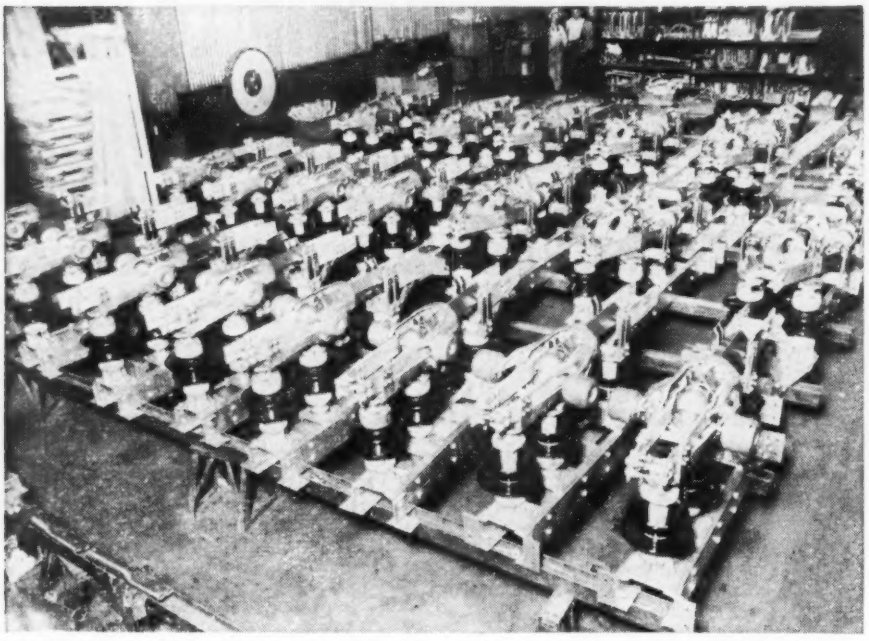


NEW MACHINE TOOLS and added assembly space are producing results for Delta-Star Electric Co, Chicago. Here are the first fruits of the new facilities: Front row, the first 3,000-amp, 23-kv, FMK-39 switches; directly behind are the first 5,000-amp, 23-kv, MK-39 switches

Delta-Star Electric Expanding Facilities to Meet Utilities' Construction Demands

Because planned utility construction in the next decade is of such magnitude that greater switchgear output will be necessary, Delta-Star Electric Co, Chicago, has begun a long-range expansion program. Modern machine tools will be added, floor space increased, field representation strengthened, and research and new product development intensified.

"We at Delta-Star have always been aware of our responsibility in designing and supplying tailor-made equipment to perform a specific duty in a specific application." Harriet H. Young, president of the company, told ELECTRICAL WORLD last week. "National leaders in the utility field are now talking about one billion dollar annual construction budgets for the next five years. We are getting our organization ready to serve the industry in its long-range thinking."

She also stated that system demands will increase to such an extent that heavier current capacity switching equipment of simpler design must be provided to equip adequately the substations and circuits of the future.

Despite record production, the company has added 35 new machines of most modern design. These have already proved their worth, C. Stuart Beattie, vice-president in charge of engineering and production, revealed. The company is rearranging its plant to secure greater use of its floor space and has bought 300,000 sq ft of adjoining land for plant expansion. Steel fabrication capacity will be doubled by April, 1948. By this time, the company hopes to improve delivery dates.

Speaking of the substation and switching equipment needs of the future, Stanley C. Killian, chief engineer, indicated that "the apparatus of the future must be even more simple and more foolproof than that of the past. We are now working on designs with those basic thoughts in mind. Some of these will be available in 1948."

Swiss Subsidiary Formed by Minneapolis-Honeywell

Organization of a new subsidiary company in Switzerland has been announced by the Minneapolis-Honeywell Regulator Co, Minneapolis.

Named Honeywell A.G., the new company has started operations with completion of legal formalities and the hiring of operating personnel. The Swiss organization will handle sales and service of the complete line of Honeywell controls as well as all of the industrial recording and controlling devices made by the Brown Instrument Co, wholly owned Honeywell subsidiary.

Intensified interest in automatic heating as well as growing industrial activity in Switzerland were cited by Harold W. Sweatt, president, as reasons behind the formation of the new company.

Charles B. Meech has been transferred to Zurich as manager of the subsidiary company. Mr Meech joined Honeywell in 1936 and has been with the company's international division at the home office since his discharge from military service in 1946. Leo de Bruyn, a member of Honeywell's international division, will assist Mr Meech. Other members of the Zurich staff are natives of Switzerland.

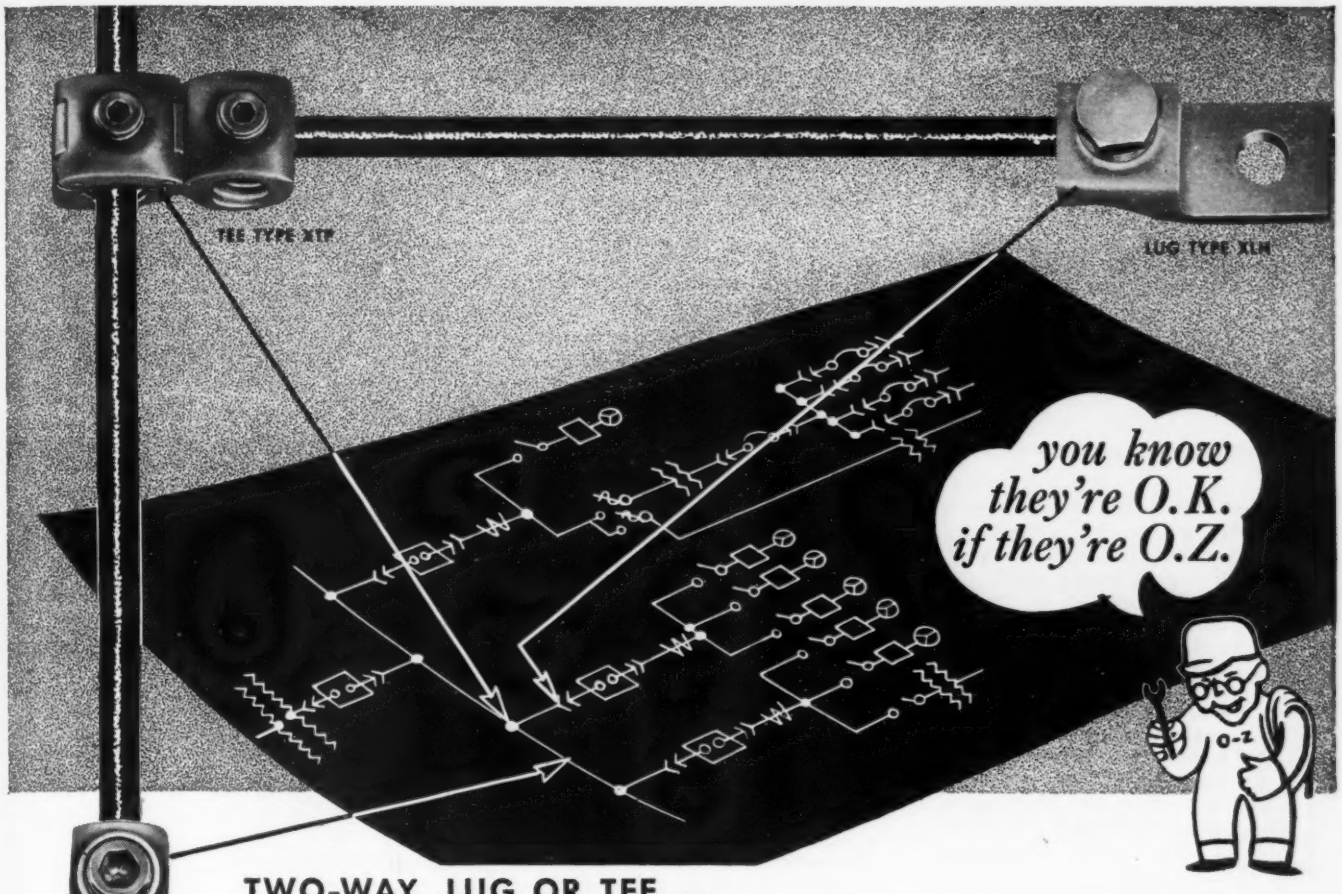
•

Bakelite Corp Opens New Mexican Plastics Plant

A new plant for the production of plastic molding materials will begin operations at Montorrey, N. L. Mexico early in November, the Bakelite Corp has announced.

Opening of this plant, under construction since October. 1946, will mark initial activities of the new subsidiary corporation, Bakelite de Mexico S. A., with main sales offices at Sidar Y Rovirosa 118, Mexico, D.F., Mexico. The new plant will produce Bakelite general-purpose phenolic materials for household and electrical appliances, closures, camera cases, and housings of all types. The plant will also serve as the Mexican sales agent for all Bakelite Corp products made at Bound Brook, N. J.

The plant will employ local labor



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GET PERMANENT CONNECTIONS WITH ALL THREE . . .

TWO-WAY TYPE XW

Whenever you're tapping, butting, terminating, put in **O.Z.** solderless connectors—then you're sure of permanent connections . . . *always*. There's a solderless connector in O. Z.'s complete line of thirty different types that will assure you fast, easy installation—as well as positive, strong connections—on any wire in any of the wide range of sizes used in building installations. Here are a few of the features that make O. Z. solderless connectors outstanding:

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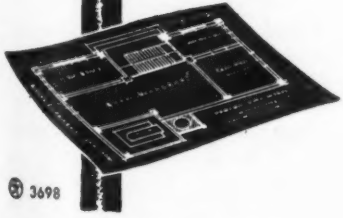
Highly conductive copper alloy body that is acid dipped to assure low resistance contact.

Extra strong copper alloy bolts and hinged parts that guarantee strong contacts, give lasting mechanical strength.

Simplicity of one-piece construction for speed of assembly—no parts to lose.

Ask nothing less than permanency of the connectors you use! Ask your distributor for O. Z. solderless connectors. He can supply an O. Z. connector for every type of application. He also carries a full line of O. Z. Insulated Bushings, End Fittings, and Split Couplings—equally unmatched for performance!

All types of O. Z. solderless connectors are satisfactory for aluminum building wire if ordered with the special Cadux plating.



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•

Manufacturers Issue Earnings Reports

Among the electrical manufacturing companies that have recently issued reports on earnings are the following:

KIDDE (WALTER) & CO—Six months to June 30, net income, $173,000 or 76 cents each on 209,800 common shares on sales of $6,324,000.

THOMAS A. EDISON—Six months to June 30, consolidated net income of $659,014, equal after preferred dividend requirements to $1.51 a share on the combined class A and class B common shares. In similar period last year, consolidated net income was $34,261. Sales were $13,845,762, against $8,843,983 a year ago.

LINE MATERIAL—Including subsidiaries with exception of Canadian subsidiary, for six months ended June 30, gross sales $16,516,164, compared with $10,541,432 for similar period of 1946. Net profit after charges and federal taxes $1,102,274, compared with $229,662.

BLAW-KNOX—Six months ended June 30, shipments and billings $25,682,668 and unfilled orders of June 30 last were approximately $28,000,000. During the second quarter the company completed renegotiation of war contracts for 1945 by payment to the government of $3,254,798. This concluded all adjustments of war contracts. Net profit for the quarter ended March 31, 1947, was $773,522 or 58 cents a share, against $28,936, or two cents a share in the like 1946 quarter.

•

Anaconda Wire Cuts Prices on Two Copper Wires

Anaconda Wire & Cable Co has announced a reduction of 80 points in the base price for bare copper wire, making the new price 27.42 cents a pound for less than car-load lots. The base price for weatherproof wire is reduced 52 points to a level of 28.10 cents a pound for less than car-load lots.

There is no change in the price for magnet wire, which remains at 30.50 cents a pound.

The company stated that the price reductions in bare and weatherproof wire have been made so as to approximate current market levels for these products on a competitive basis.

•

Vacuum Cleaner Sales Rise

Factory sales of standard size household vacuum cleaners in August totaled 277,288, compared with 226,080 in August, 1946. Sales for July were 280,585 units.

Always Specify
"AMERICAN HOIST"
and you'll get blocks and sheaves with
ARMORED CONSTRUCTION!
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EXTRA Holding Power
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For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

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AMERICAN ELECTRICIAN HANDBOOK

A Reference Book for Practical Electrical Workers

By **TERRELL CROFT**, Consulting Electrical Engineer. Revised by Clifford C. Carr, Head of Electrical Engineering Department, Pratt Institute. **Fifth Edition, 1600 pages, 5x7½, 1177 illustrations, 64 tables. $5.00.**

This book is packed from cover to cover with the facts which every man engaged in electrical work needs. From clear explanations of the fundamentals of electricity, to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men select and install commercial electrical apparatus and materials, operate electrical equipment efficiently, and maintain it at high operating efficiency.

PRINCIPLES OF RADAR

By **Massachusetts Institute of Technology Radar School Staff.** 960 pages, 6x9, profusely illustrated, **$5.00.**

Here's the latest data on basic radar circuits. Completely revised, the new edition deals with pulse circuits and high-frequency devices common to most radar equipment. It begins with a brief description of the components and functions of radar systems and continues with detailed discussion of typical system components. Emphasis in the explanation of circuits is on quantitative analysis directly from tube characteristics and physical principles.

TRANSMISSION LINES

Design, Construction and Performance

By **FRED C. DEWEESE**, General Engineer, Carolina Power and Light Company. **297 pages, 5¼x8, 182 illustrations and tables, $3.50.**

Deals exclusively with the design, construction, and day-in, day-out performance of high-voltage transmission lines. An authoritative, easy-to-follow guide to transmission line work, the book presents step-by-step procedures from simple short-line problems, through lone high-voltage line problems requiring involved mathematics for their solution.

AN INDEX OF MATHEMATICAL TABLES

By **A. FLETCHER** and **J. C. P. MILLER**, Lecturers in Applied Mathematics, and **L. ROSENHEAD**, Professor of Applied Mathematics, University of Liverpool. **450 pages, 6x9, $16.00.**

This up-to-date guide brings you over 2,000 mathematical tables of practical use. An indispensable handbook for every engineer and scientist, it puts into your hands a complex index to all published—and some unpublished—mathematical tables. Part I is an index according to functions; Part II, a complete list of the tables arranged alphabetically by author. Because this is a practical volume, tables of historical interest only have been omitted.

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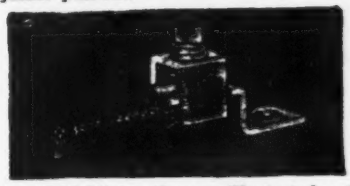
MORE THREADS gained through the deep boss

Serrations in collar and tang provide added strength against pull-out.



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A small parts bag for holding such items as tools, wood and lag screws, small hardware and parts to be assembled.

Keeps parts in easy reach and speeds up to job.

For line work it is worn attached to the body belt; general operations over the trouser belt.

Manufactured of medium weight canvas with web strap loops through which belt is inserted. Mouth of pouch reinforced with cloth covered rope to hold it open.

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K. H. HOBBIE, vicepresident of the Driver-Harris Co, Chicago, and president of the Machine Tool Congress, extends thanks for NEMA's cooperation with the Congress and stresses the role electricity plays in industry

IGE Gets Export Rights

International General Electric Co, Inc, has received export rights for Aer-VoiD Automatic electric water heaters, according to C. G. Roberts, manager of the electronics and merchandise division, Schenectady. International has added these heaters to its line because of the demand for automatic meter heaters in small sizes, Mr Roberts said.

•

Anaconda Wire Dividend

A common dividend of $3 a share on the common stock has been voted by Anaconda Wire & Cable Co, payable on October 21. Previous payments this year were $3 in July and 50 cents in April.

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No expensive replacements if you install Premax All - Metal Stamped and Embossed Markers.

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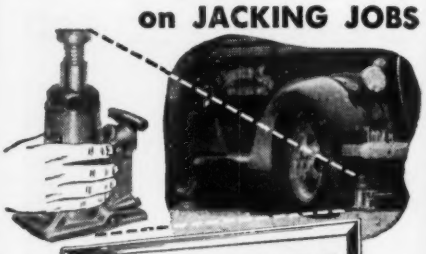

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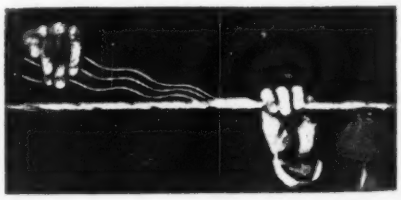

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FOG NOZZLES DO NOT FAIL!

Wide clear passages through the heart of this dependable Fog Nozzle makes it virtually non-clogging—always reliable.

It fights fire with the water available—maintains its fog pattern under low pressures in emergency.

Fine but forceful fog gives maximum cooling and quenching effect and drives to the base of the fire in spite of drafts and turbulence.

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Blaw-Knox offers Standard Wet and Dry Pipe Systems, as well as Thermostatically Controlled Pre-Action and Deluge Systems.

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CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Calif., Fort Ord—Office of Purchasing Branch, Fort Ord, exten. serial street lighting sys.

Calif., San Francisco—Pacific Gas & Electric Co., 245 Market St., 5 story, rein.-con. substation, 8 and Mission Sts.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, transformers, power circuit breakers, disconnecting switches, and instrument transformers for Estes and Marys Lake Switchyards, Colorado-Big Thompson Proj., Spec. 1924. W. R. Young, ch. engr.

D. C., Anacostia—Pub. Wks. Officer, Potomac River Naval Command. Naval Gun Factory, Wash., D. C., installing air conditioning equip., cooling coils, compressors, condensers, piping, controls, electrical work, accessories in Bldg. 150, Naval Air Station, Spec. 18872. Plans deposit $10.

Fla., Jacksonville—City, furnishing f.o.b. cars at site of Power Plant 2, two oil burning steam generating electric units. Plans deposit $5. Reynolds, Smith & Hills, 10 S. Laura St., engrs.

Fla., Miami—Florida Power & Light Co., MacGregor Smith, pres., Ingraham Bldg., electric generating power plant at Cutler. **$350,000** or more.

Iowa—Woodbury County Rural Electric Co-operative, Moville, 206.3 mi. rural distr. lines, Woodbury Co. **$380,000.** Philip L. Burns, 730 Davenport Bank Bldg., Davenport, engr. CD 3/27.

Kansas—P. R. & W. Electric Co-operative, Wamego, rural distr. lines, Pottawattamie, Riley, Wabaunsee Geary, and Jackson Counties. **$445,000.** Frank Horton & Co., Lamar, Mo., consult. engrs.

La., Houma—City, voted bonds, power plant. **$875,000.**

Mich., Lincoln Park—John M. O'Connor, city clk., Lincoln Park, 2 storm water pump. stations with connections, appurtenances; furnishing, installing 4 electric motors, 125 to 300 hp. and two 15 hp. motors, lighting equip., etc. Plans deposit $10 each. Pate & Hirn, 532 Michigan Bldg., Detroit, engrs.

Minn., Marshall—City, Light, Heat & Water Bd., H. N. Harmon, secy., furnishing, installing, turbo generator, condenser, accessories, at municipal power plant. Over **$55,000.** Plans deposit $25. R. D. Thomas & Assoc., 400 Metropolitan Life Bldg., Minneapolis, engrs.

Nebraska—Norris Rural PP Dist., Beatrice, rural distr. lines, Lancaster, Gage, Jefferson, and Saline Counties. **$508,000.** Phillips Burns, 730 Davenport Bank Bldg., Davenport, Ia., consult. engr.

N. M., Taos—Kit Carson Electric Co-operative, Taos, power plant extens., imprvs. Beavers & Lodal, Transit Tower Bldg., San Antonio, Tex., engrs.

New York—Buffalo Niagara Electric Corp., Electric Bldg., 80,000 kw. steam generating station on one of four Western New York sites. **$10,000,000.**

N. Y., Brooklyn—Pub. Wks. Office Bldg. 77, New York Naval Shipyard, Brooklyn, Zone 1, facilities for jet condensers bldg. 128, Spec. 18815. Plans deposit $10.

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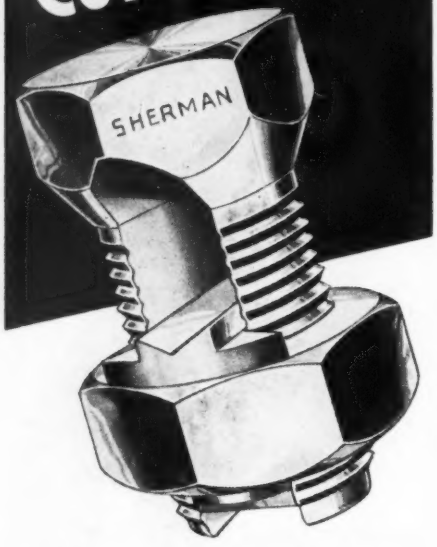

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mgr., Sect. 1, boiler room addn. and alterations, Sect. 2, furnishing, installing handling equip.; Sect. 3, furnishing switchgear sub-station and switchboard equip.; Sect. 4, furnishing, constructing cooling tower; Sect. 5, furnishing one induced draft fan. Plans deposit $20. Wm. C. Olsen, 5 Exchange Pl., Raleigh, engr.

Low Bidders & Contracts Awarded

Fla., Jacksonville—City, bldg. constr. and equip. at McDuff Ave., 66/13.8 kv. substation for electric power distr., to Southern States Equip. Corp., Hampton, Ga., **$57,440;** supplying 2 emergency pumps for McDuff Ave. substation, to Burford Hall & Smith, 140 Edgewood Ave. N.E., Atlanta, Ga., **$10,780.** Bids 9/4, awarded 9/20.

Wis., Port Washington — Wisconsin Electric Power Co., 231 W. Michigan St., Milwaukee, Zone 3, 1 story, 115x250 ft., brick, concrete, steel power plant addn., to Hunzinger Constr. Co., 4541 N. 124 St., Milwaukee, Zone 13. Est. **$11,000,000** incl. equip. F. A. Luber, c/o owner, archt.

INDUSTRIAL COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

La., New Orleans—Doctor's Memorial Hospital, c/o Dr. Charles B. Odom, chn., 1521 Delachse St., plans by Freret & Wolf, 630 Gradvier St., 12 story, bsmnt., masonry 300-bed doctors memorial hospital, partial air-conditioning. **$3,500,0000.**

N. Y., New York—Mt. Sinai Hospital, 5 Ave. and 100 St., Zone 29, plans by Kahn & Jacobs, 2 Park Ave., Zone 16, hospital, 1 E. 100 St. **$4,600,000.** Fred N. Severud, 415 Lexington Ave., Zone 17, consult. engr.

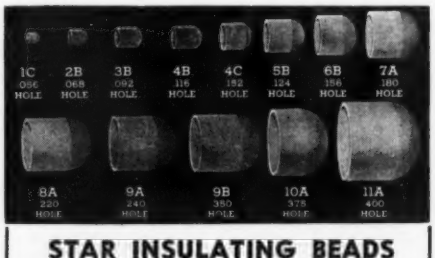
Okla., Tulsa—Sunray Oil Corp., Philtower Bldg., and First Natl. Bank & Trust Co., 325 S. Main St., Tulsa, 24 story, bsmnt., masonry office, 5 St. and Boston Ave., air-conditioning. **$3,500,000.**

Pa., Hazelton—Electric Auto Lite Co., Champlain and Mulberry Sts., Toledo, O., 1 story, 300x700 ft., brick, steel and glass mfg. plant. **$1,000,000.** William Whalen, c/o owner, ch. engr.

Wash., Yacolt—Harbor Plywood Corp., Hoquiam, plywood plant, door plant, sawmill and shingle mill. **$5,000,000.**

Low Bidders & Contracts Awarded

Pa., Phila—Dpt. Property & Supplies, 18 and Herr Sts., Harrisburg, Sept. 24, general contract Active Therapy Bldg. N-3 Philadelphia State Hospital (Byberry) from Wark & Co., 1700 Sansom St., **$1,618,770*****heating and ventilating, from Warren J. Cathcart, 4636-38-40 Paul St., **$231,415*****plumbing and drainage, from C. E. Williams Co., Inc., 1261 N. 26 St., **$206,666*****electrical work, from The Howard P. Foley Co., 1630 Pine St., **$117,300*****elevators, from General Elevator Co., Inc., Bush and Ridgely Sts., Baltimore, Md., **$73,650.**



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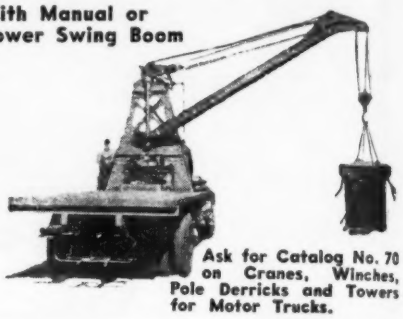

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BOOK REVIEWS

Generators and Motors and Their Applications. By D. J. Duffin. Published by McGraw-Hill Book Co., New York. 210 pages, illustrated. Price $4.

Principle of operation and commercial forms of a comprehensive array of a-c and d-c machines (large and small) are detailed and depicted. Then follow elaborate tables showing how to select motors appropriately for specific applications, and other tables classifying the troubles and remedies for the trouble-shooter and electrical diagnostician. Manufacturers collaborated extensively in the compilations and discussions.

Standard Costs for Manufacturing. By S. B. Henrici. Published by McGraw-Hill Book Co., New York. 289 pages, illustrated. Price $3.50.

Interest of electrical manufacturers in this treatment will be much the same as that of any other group of manufacturers, because it deals with principles and implementation of the controls and analyses that make the difference between profit and deficit. Another group who should derive real help from it are the power sales engineers of electric utilities, whose clients most of the manufacturers in an area are. If they want their power patrons to be competitively successful and fear some are not, they can offer suggestions once they have familiarized themselves with the procedures here expounded and detailed. They can show them how adoption of new and better materials and new and better processes (infrared, induction heating, welding, electropolishing, etc.) can improve their operations and their costs, if properly recorded and studied. Of particular import should be the chapter devoted solely to the items of power and fuel consumption.

Heat Pumps. By Philip Sporn, E. R. Ambrose, and Theodore Baumeister. Published by John Wiley & Sons, Inc, New York, N. Y. 188 pages, illustrated. Price $3.75.

Long-awaited first text on technical applications of electric heating through refrigerating machinery, this terse book begins with a discussion of the thermodynamic principles and basic heat-pump designs. It covers the entire field of equipment types, heat sources, equipment selection, economics and includes a review of the potentialities of the heat pump as electric utility load.

Pioneers in applying heat pumps to residential heating in the U. S. A., the authors have aimed their text at a wide audience of both engineers and management, giving sufficient technical data for the one and clear explanation for the other group. A chapter on industrial cycles forecasts a further potential field for the heat pump in evaporation, distillation and concentration, wherever a temperature differential is used in process industries. A review of existing installations in this country and abroad quotes a range of performance data.

Lessons in Arc Welding. Third edition, published by the Lincoln Electric Co, Cleveland, Ohio. 158 pages, 228 illustrations. Price 50 cents in U. S. A., 75 cents elsewhere.

Instructions in all phases of arc welding for new or experienced welders in simple language. Completely revised. Thirty pages of questions and answers, new data on a-c welding, pipe welding and hard facing.

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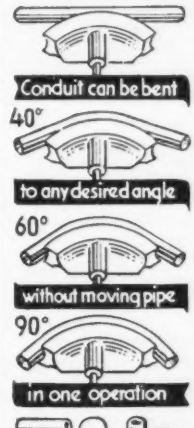

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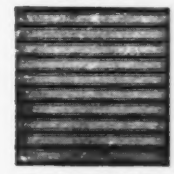
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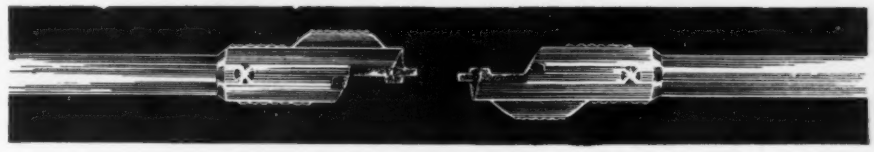

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